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Rev. Fr. J. F. CAIUS, S.J., F.L.S., H. M. MCGUSTY,
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Pages 320–322. Wherever '*Coleus vettiveroides*' occurs read as '*Coleus Vettiveroides*'.

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Page 839, line 4 from top. Add *Rhodocleptria incarnata*. Flies in spring.

Page 841, line 42 from top, For 'classes' read 'class'.

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Bridge, M. F. (I.F.S.) ... ... England.
Brindley, James C. ... ... Calcutta.
Bruce-Steer, Col. J. M. ... ... Simla.
Budd, B. W. (I.C.S.) ... ... Mirpurkhas.
Buckwell, Capt, B.A. (R.A.) ... ... Lahore.
Burder, John H. ... ... Calcutta.
Burdon, T. W. (I.P.) ... ... Lahore
Burma, H. E. The Governor of ... ... Simla.
Burnett, Major R. R. (O.B.E.) ... ... ,,
Buxton, Capt. Aubrey ... ... Bombay.
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Calcutta Zoological Gardens. The Hon. Secretary ... Calcutta
Cambridge, University Museum of Zoology, The
Superintendent ... ... Cambridge
Cameron, E. G. ... ... Nilgiris.
Campbell, S. ... ... Bara Jamda.
Capito, C. Erik (O.B.E., M. I. C. E.) ... ... England.
Captain, Mrs. Alice H. C. ... ... Bandra.
Cardew, Col. C. G. (R.E.) ... ... Naini Tal.
Carnegie Museum, The Director ... ... U. S. A.
Cassell, R. H. ... ... Moniarah.
Cave, Capt. F. O. ... ... England.
Chamier, Lt. General R. O. (C.I.E.) ... ... Bombay.
Champion, F. W. (I.F.S.) ... ... Naini Tal.
Champion, H. G. (I.F.S.) ... ... England.
Champion, Rev. M. G. ... ... Poona.
Champion-Jones, R. N. ... ... India.
Chance, P. V. (B.A., T.C.D.) ... ... Nagpur.
Channer, Maj. Genl. G.O. De R. (C.B.E., M.C., A.D.C.) New Delhi.
Chaudhri, C. M. (I.F.S.) ... ... Ranchi.
Chevenix-Trench, C. G. (I.C.S.) ... ... England.
Chisholm, D. F. F. ... ... Calcutta.
Christie, Capt. S. F. ... ... Bombay.

Christison, Major-General A. F. P. (M.C.) ...	Quetta.
Clark, George D.	Bengal.
Clayton, Dr. R. V. (V.D., M.B.B.S., D.P.H., D.M.R.E.).	Africa.
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Clough, R. J.	Calcutta.
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Allahabad Club, Ltd.	Allahabad.
Belgaum Club, The Honorary Secretary ...	Belgaum.
Bengal Club, Ltd., The Secretary	Calcutta.
Bombay Club, The Honorary Secretary ...	Bombay.
Bombay Gymkhana Ltd., The Secretary ...	,,
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Cacher Club Co., Ltd.	Cachar.
Central Provinces Club, Ltd.	Nagpur.
Club of Western India, The Honorary Secretary ...	Poona.
Darjeeling Club, Ltd.	Darjeeling.
I. D. Gymkhana Club, Ltd.	New Delhi.
Mawlaik Gymkhana Club, The Honorary Secretary.	Mawlaik.
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Ranikhet Club, The Honorary Secretary ...	Ranikhet.
Royal Bombay Yacht Club, The Secretary ...	Bombay.
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Srinagar Club, The Secretary	Srinagar.
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Cole, Lt.-Col. B. L.	Ootacamund.
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Agricultural College and Research Institute, The Librarian	Coimbatore.
Ajmer, Government College	Ajmer.
Allahabad Agricultural Institute	Allahabad
American College, The Bursar	Madura.
Barnes High School, The Head Master ...	Deolali.
Baroda College, The Principal	Baroda.
Bengal Agricultural Institute	Tejgaon (Dacca).
Bikaner, Dungar College	Bikaner.
Bose Institute, The Director	Calcutta.
Burma Forest School, The Director	India.
Calcutta, The Presidency College	Calcutta.
Calcutta School of Tropical Medicine and Hygiene, The Director	,,
Carmichael Medical College, The Principal ...	,,
Central Research Institute, The Director ...	Kasauli.
China, The Science Society of China Library ...	Nanking.
Chulalongkorn University Library	Bangkok.
Dartmouth College Library, The Librarian ...	Hanover, U.S.A.
Dayaram Jetharam Sind College	Karachi.
Forest Research Institute, The Forest Botanist ...	Dehra Dun.
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Gordon College	Rawalpindi.

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Gwalior Victoria College, The Principal ...	Gwalior.
Haffkine Institute, The Director	Bombay.
Indian Forest Ranger College, The Director ...	Dehra Dun.
Indian Lac Research Institute	Namkum.
Indian Military Academy	Dehra Dun.
Institute of Plant Industry, The Director ...	Indore.
Intermediate College Association	Bangalore.
Islamia College. The Principal	Peshawar.
Jat V. Int. Agri. College	Meerut.
Karnatak College, The Principal	Dharwar.
King Institute, The Director...	Guindy.
La Martiniere College, The Principal	Lucknow.
Lingnan University Library	Canton.
Ludhiana, Government College, The Principal ...	Ludhiana.
Madras Christian College, The Librarian ...	Tambaram.
Maharaja's College, The Principal	Ernakulam.
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Nowrosjee Wadia College, The Principal ...	Poona.
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Osmania University, Head of Botany Department.	,,
Oxford Mission School	Behala.
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Presidency College, The Principal	Madras.
Rajaram College, The Principal	Kolhapur.
Ravenshaw College, The Principal	Cuttack.
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Royal Institue of Science, The Principal ...	Bombay.
Samaldas College, The Professor of Biology ...	Bhavnagar.
Secondary Training College, The Principal ...	Bombay.
St. Berchman's College, The Principal	Changanacherry.
St. Mary's High School, The Rector	Bombay.
St. Mary's Training College	Poona.
Trivandrum, H. H. Maharaja's College for Women.	Trivandrum.
University College, The Principal	Rangoon.
University College, The Principal	Colombo.
Vanita Vishram Training College	Bombay.
Victoria Technical Institute, The Curator ...	Nagpur.
Wilson College, The Principal	Bombay.
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Woodstock School, The Biology Teacher ...	Mussoorie.
Colombo Museum, The Librarian	Colombo.
Colvin, Lt.-Col. E. J. D. (I.A., C.I.E.)	Baroda.
Congreve, C. R. T.	Nilgiris.
Connell, F. J.	Karachi.

Connor, Maj.-General Sir Frank (*Kt.*, D.S.O., F.R.C.S., I.M.S.)	England.
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Conservator of Forests, Bhopal State	Bhopal.
Conservator of Forest, Cochin Government ...	Trichur.
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Conservator of Forests, the Chief	Srinagar.
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Cowper, G. St. John	,,
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Crawford, William G. (I.F.S.)	Naini Tal.
Crofton, R. M. (C.I.E., I.C.S.)...	Hyderabad, Dn
Croix, O. H. de St.	Nagpur.
Crombie, A. D. (C.I.E., I.C.S.)	Madras.
Culshaw, Miss K. H.	Aler.
Currie, A. J.	London.
Currie, M.M.L. (I.C.S.)	,,
Dabholkar, Lt.-Col. A. Y. (I.M.S.)	Poona.
Dalal, Merwanji Bomanji	Bombay.
Dalal, M. P. M.	,,
Danta State, H. H. The Maharanaji Sahib Bahadur (K.C.S.I.)	Danta-Bhavangadh.
Darjeeling, The Curator, Nat. Hist. Mus. ...	Darjeeling.
Daver, Framroze A.	Bombay.
Davies, T. G. B. (A.R.S.M., ST.M.I.P.T.)	Khaur.
Davies, Major V. K. N. (I.A.)	Bombay.
Davis, D. (I.F.S.)	,,
Davis, The Hon'ble Sir Godfrey (*Kt.*, I.C.S.) ...	Karachi.
Davis, P. W. (I.F.S.)	Coimbatore.
Davis, Capt. T. A. W. (R.A.S.C.)	Jullundur Cantt.
Dee, Lionel	Travancore.
De Haas, C. P. J.	Java.
Delacour, Mons Jean	France.
Deo, Raja Sri Balavadra Narayan Bhunj	Keonjhargarh.
DeRhe Philipe, G. W. V. (F.E.S.)	London.
Dewas Sr., H. H. Maharaja Vikram Singrao (K.C.S.I.)	Dewas Sr.
Dewas Junior, Shreemant Capt. Y. B. Pawar Yuvaraj, of	Dewas Jr.
Dickins, Lt. M. J.	Bombay.
Dickson, Lt.-Col. H. R. P. (C.I.E.)	Persia.
Dinajpur, Maharaja Jagadish Nath Ray	Dinajpur.

Director of Museums, S. S. & F. M. States ... Kuala Lumpur.
Dods, W. K. ... ... Calcutta.
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Donald, Capt. J. O. S. ... ... N.W.F.P.
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Douglas, Miss Margaret ... ... Jalna.
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Duke, A. H. ... ... Bangkok.
Duke, Bt. Lt.-Col. C. L. B. (M.C., R.E.) ... ... Roorkee.
Dunbar-Brander, A. A. (O.B.O., I.F.S.) ... ... Scotland.
Dunbar, U. B. H. ... ... India.
Duncan, Lt.-Col. D. L. ... ... Colombo.
Dunlop, S. W. C. (I.C.S.) ... ... Bezwada.
Dunsdon, A. C. ... ... Calcutta.
Durand, C. H. S. ... ... Bombay.
Dyson, R. A. ... ... London.
East India Railway European Institue ... ... Allahabad.
Eates, K. R. (I.P., F.Z.S., M.B.O.U.) ... ... Karachi.
Edwards, M. Vincent (I.F.S.) ... . New Delhi.
Eliot, John N. ... ... London.
Eliott-Lockhart, Major Wm. ... ... Bombay.
Ellis, Ralph ... ... California.
Emerson, C. A. ... ... England.
Emerson, Gerald H. (I.C.S.) ... . Waziristan.
Emerson, Major J. ... ... Bombay.
Etaiyapuram, The Rajah of ... ... Etaiyapuram.
Evans, Col. G. H. (C.I.E., F.L.S.) ... ... London.
Evans, Brigadier W. H. (C.S.I., C.I.E., D.S.O.) ... England.
Ezra, Sir Alwyn, *Kt.* (F.R.G.S., F.Z.S.) ... ... Bombay.
Fawcus, L. R. (I.C.S.) ... ... Calcutta.
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Ferrar, Lt.-Col. M. L. (I.A., O.B.E., C.S.I.) ... England.
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Fischer, C. E. (R.E.) ... ... Fatehgarh.
Fisher, J. Barling (Bar-at-Law, F.R.G.S.) ... Tellicherry.
Fletcher, Thos. Bainbrigge (F.R.E.S., F.L.S.) ... England.
Fooks, H. A. ... ... Calcutta.
Foot, A. E. ... ... Dehra Dun.
Forrington, Arthur ... ... Bombay.
Fountaine, Miss Margaret (F.R.E.S.) ... ... London.
Fraser, Capt. A. G. L. (I.M.D.) ... ... Wellington.
Fraser, Duncan ... ... London.
Fraser, K. H. ... ... Tellicherry.
Fraser, Capt. L. J. D. (I.A.) ... ... India.
French Indo-China, His Majesty S. M. Bao-Dai,
Emperor of Annam ... ... F. I. China.
Frend, G. V. R. ... ... Kadur.
Frome, N. F. (D.F.C., M.SC., M.I.E.E.) ... ... New Delhi.
Fyzee, A. A. A. (M.A., LL.B., Bar-at-Law) ... Bombay.

Gabb, H. B.	Calcutta.
Gardiner, J. E.	Nasirabad.
Garthwaite, P. F. (I.F.S.)	India.
Garbett, Sir Colin (K.C.I.E., C.M.G., C.S.I., F.R.G.S., I.C.S.)	Lahore
Geddis, A.	Bombay.
Gee, E. P.	Badlipar
Gemmell, G. W.	Calcutta.
George Hugh S. (I.F.S.)	Nagpur.
George, J.	Bombay.
Ghosh, S. K. (I.C.S.)	Shillong.
Gibbon, Herbert	Vandiperiyar.
Gibbons, J. M. B.	Bombay.
Gibson, Sir Edmund (K.C.I.E., I.C.S)	Dehra Dun.
Gill, E. H. N. (F.Z.S.)	Sitapur.
Gill, H. A. C. (I.C.S.)	Delhi.
Gimson, C. (I.C.S.)	Imphal.
Glenn, E. B.	Calcutta.
Glennie, Lt.-Col. E. A. (D.S.O., R.E.)	Dehra Dun
Goodwin, F. W.	Simla.
Gordon, Major J. W.	Jodhpur.
Gough, Lt.-Col. W.	Dehra Dun.
Gould, Sir Basil (C.I.E., I.C.S., C.M.G.)	Gangtok.
Gouldsbury, C. P.	Travancore.
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Director, Bureau of Science	Manila.
Director of Agriculture, Punjab	Lahore.
Director of Agriculture, Baghdad	Iraq.
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Gravely, Dr. F. H. (D.SC.)	Kodaikanal.
Gray, James	Devicolam.
Greaves, Mrs. D. I.	Bombay.
Greaves, J. B. (C.B.E., M.L.A., J.P.)	,,
Greenwood, J. A. C.	Madras.
Gwalior, The Director of State Gardens	Gwalior.
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Hall, James A.	Kollengode.
Hall, J. E.	Roorkee.
Hambly, R. L.	Calcutta.
Hamidkhan Bhatti, Dr. M. (M.SC., LL.B., Ph.D.) ...	Lyallpur.
Hamilton, Major C. S. P. (D.S.O., M.R.C.S., L.R.C.P., R.A.M.C.)	Sylhet.
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Hancock, Lt.-Col. C. P. (C.I.E.)	New Delhi.
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Harper, Lt.-Col. A. Forrest	London.
Harper, William	Cawnpore.
Hartnoll, E. S. (I.F.S.)	Srinagar.
Harvey, Lt.-Col. C. W. L. (M.C., C.B.E.) ...	Indore.
Hasted, Major J. S. Holy	Dehra Dun.

Hate, Prof. Vinayak N. (B.Sc.)	Bombay.
Hawes, C. G. (C.I.E.)	Karachi.
Hawkins, R. E.	Bombay.
Hay, Lt.-Col. R. (I.M.S., C.I.E.)	New Delhi.
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Heaney, Lt.-Col. G. F. (R.E.)	Calcutta.
Henry, H. A.	Karachi.
Heslop-Harrison, Dr. G	Bombay.
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Hewetson, C. E. (I.F.S.)	,,
Hewitt, Walter A.	Gonda.
Heysham, R. K.	Bombay.
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Higgins, J. C. (C.I.E., I.C.S.)	Bombay.
Hiley, A C. (C.I.E., I.F.S.)	Poona.
Hill, D. G. (F.R.G.S., J.P.)	Bombay.
Hillyer, R. A. N.	Haiti.
Hindmarsh, Lt.-Col. J. H. L.	Bombay.
Hislop, Lt.-Col. J. H. (M.C., I.M.S.)	,,
Hocking, Brian (I.A.O.C.)	Cawnpore.
Hodson, G. A. (B.F.S.)	London.
Hodson, Lt. R. V. E.	Sialkot.
Hoey, Capt. C. F.	New Delhi.
Holland, Major G. M.	Bombay.
Holmes, H. R.	England.
Hook, Major Peter	New Delhi.
Hopkinson, A. J. (C.I.E., I.C.S.)	Kalat.
Hora, Dr. Sunder Lal (D.Sc.)	Calcutta.
Hoshang, N. E. Dinshaw	Karachi.
Hotz, Edwin	Delhi.
Howard-Bradshaw, Comdr. C. T. (R.N.)	England.
Howell, Sir Evelyn (K.C.I.E., C.I.E., I.C.S.) ...	London.
Howey, A. J. E.	England.
Hubback, Theodore R.	Pahang.
Hughes, Capt. A. R.	India.
Hughes, Mrs. M. A.	Kalimpong.
Hunt, L. E.	Bombay.
Hyderabad, Dn., Economic Botanist to Government, C. A. Library	Himayatsagar, Dn.
Hyderabad, Dn., Supdt. of Fisheries	Hyderabad, Dn.
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Imperial Council of Agricultural Research ...	New Delhi.
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Jackman, Capt. R. C.	Fort-Sandeman.
James, E. R. Sherman	Assam.
James, J. N. A.	Ajmer.
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Joly, Dr. B. M.	New Delhi.
Jones, A. E.	Simla.
Jones, A. J. Turnley	Naini Tal.
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Lahore, University of Punjab, The Librarian ...	Lahore.

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United Service Library, The Honorary Secretary ... Poona.
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Lucknow, Provincial Museum, The Curator ... Lucknow.
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Madras, H. E. The Governor of ... ... Madras.
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Malden, F. R. E. ... ... Khaur.
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Mankapur Raj, Raja Ambikeshwar Pratap Singh Saheb (M.L.A.) ... ... Mankapur.
Marine Biological Laboratory ... ... Mass, U.S.A.
Martin, Carr A. ... ... India.
Matthews, W. H. ... ... Rungli-Rungliot.
Maxwell, Capt. H. A. (I.F.S.) ... ... Dehra Dun.
Maxwell, Hon'ble Sir Reginald (K.C.S.I., C.I.E., I.C.S.) ... ... Delhi.
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McLeod, Major-Genl. D. K. ... ... India.
McPherson, James ... ... England.
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Mehta, Sir Hormasji (*Kt.*, K.B.E.) ... ... Bombay.

Mehta, Jamshed N. R.	Karachi.
Mehta, K. M.	Bhavnagar.
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Meinertzhagen, Lt-Col. R.	London.
Menesse, N. H. (I.S.E.)	Karachi.
Merrill. Major W E., (I.A.)	Dehra Dun.
Meston, D. C.	Assam.
Michael, J. D.	Delhi.
Milburne, W.	Barjuli.
Miller, G. D. L.	Assam.
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IXORA COCCINEA R. Br.
($\frac{9}{10}$ nat. size.)

JOURNAL
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1941. VOL. XLII. NO. 3.

SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS.

BY

N. L. BOR, M.A., D.SC., F.L.S., I.F.S.,

Forest Botanist,

AND

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PART VII.

(*Continued from Vol.* xlii, No. 2 (1941), p. 241).

(*With* 2 *coloured and* 8 *black and white plates and* 11 *text-figures*).

Rubiaceae, PART II.

4. **Ixora** Linn.

(Van Rheede states in Hortus Malabaricus that the flowers of this genus are offered to the God, *Ixora,* a fact which has obviously given rise to the generic name).

A genus of small shrubs or trees which are great favourites in Indian gardens on account of their brilliantly coloured flowers and dark green handsome foliage. The leaves are opposite, glabrous, coriaceous, and reticulately nerved. The stipules are interpetiolar, simple, subpersistent. The inflorescence is terminal, paniculate or contracted, the branchlets being subtended by linear or subulate, free bracts and each pedicel provided with 2 bracteoles. Individual flowers bisexual, tetramerous. Calyx campanulate, adnate to the ovary, shortly 4-lobed. Corolla hypocrateriform (tube-like with spreading lobes); tube slender; lobes 4, twisted in the

bud. Stamens as many as the lobes and alternate with them; filaments short, inserted in the throat. Ovary inferior with 2 cells; ovule 1 in each cell, attached to the centre of the septum. Disk annular. Style glabrous, shortly exserted and ending in two recurved stigmatic lobes. Fruit a globose drupe. Seed semi-globose, with a deep and wide excavation on the flat side.

Key to the Species.

Flowers coloured.

Flowers yellow.

Corolla-tube 1.5 in. long; lobes broadly ovate, acute ... *I. lutea.*
Corolla-tube 1 in. long; lobes rotundate, obtuse ... *I. chinensis.*

Flowers red or reddish.

Flowers scarlet.

Corolla-tube up to 1 in. long.

Corolla-lobes rotundate, obtuse; corolla at first yellow then red ... ... *I. chinensis.*
Corolla-lobes ovate acute; corolla always scarlet. *I. coccinea.*
Corolla-tube up to 1.75 in. long ... ... *I. fulgens.*
Flowers pink ... ... *I. rosea.*

Flowers white.

Flowers less than .5 in. long.

Leaves undulate on the margin; calyx-lobes as long as the calyx-tube ... ... *I. undulata.*
Leaves not undulate; calyx-lobes much shorter than the calyx-tube ... ... *I. parviflora.*
Flowers over .5 in. long; throat of corolla woolly; corolla tube up to 1.5 in. long ... ... *I. barbata.*

Ixora coccinea Linn.

Scarlet Ixora.

(*coccinea* is a Latin word meaning scarlet-coloured, and refers to the brilliant scarlet flowers of the commonly cultivated race of this species).

Description.—A compact shrub or small tree, glabrous all over. Leaves sessile, opposite, elliptic, ovate or obovate in shape, apiculate, obtuse or mucronate at the tip, somewhat cordate at the base, thickly coriaceous in texture, 1.5-3.5 in. long, dark glossy green in colour, with 6-8 nerves on either side of the midrib. Stipules triangular, awned.

Inflorescence terminal, supported by two small, leaf-like bracts, strongly contracted, forming a compact corymb. Individual flowers with two bracteoles at the base. Calyx urceolate, .1 in. long, green, with 4 triangular acute lobes reddish or purplish at the tips. Corolla hypocrateriform, with a slender tube 1.25 in. long, surrounded by four spreading ovate acute lobes .3 in. long, which eventually become reflexed, brilliant crimson in colour. In the bud the lobes are twisted to the left. Stamens 4, on short

Photo by *M. N. Bakshi*

Scarlet Ixora (*Ixora coccinea*, Linn.)
New Forest, Dehra Dun.

filaments attached to the throat, alternate with the corolla lobes. The stamens dehisce in the bud which, when just open, displays the top of the style drenched with pollen. At this time the stigmas are immature and insects alighting on the style carry away pollen to an older flower.

Flowers.—Practically throughout the year, but is at its best during the rains. *Fruits.*—Cold season.

Distribution.—Native of the Western Peninsula; now widely cultivated throughout the tropics.

Gardening.—A shrub usually 3-4 ft. high, one of the commonest in cultivation, and certainly one of the most beautiful of the genus. It is practically in flower throughout the year, but in perfection during the rains when it is a truly glorious object to behold and few shrubs surpass the splendour of this Ixora when it is in full bloom. The bright scarlet flowers are arranged in large, compact corymbs. During flowering time an occasional application of liquid manure will be found beneficial, and it is advisable to prune rather closely after flowering. Easily raised from seed or layers or cuttings during the rains. Like all other species of this genus it prefers full sunshine. Where frost is severe some damage may be expected.

Medicinal use.—This plant has been known in India since ancient times and the root has some repute in native medicine. It is said to act as a cholagogue and to give relief from pain to those suffering from dysentery.

Ixora rosea Wall.

Pink Ixora.

(The specific name refers to the colour of the flowers).

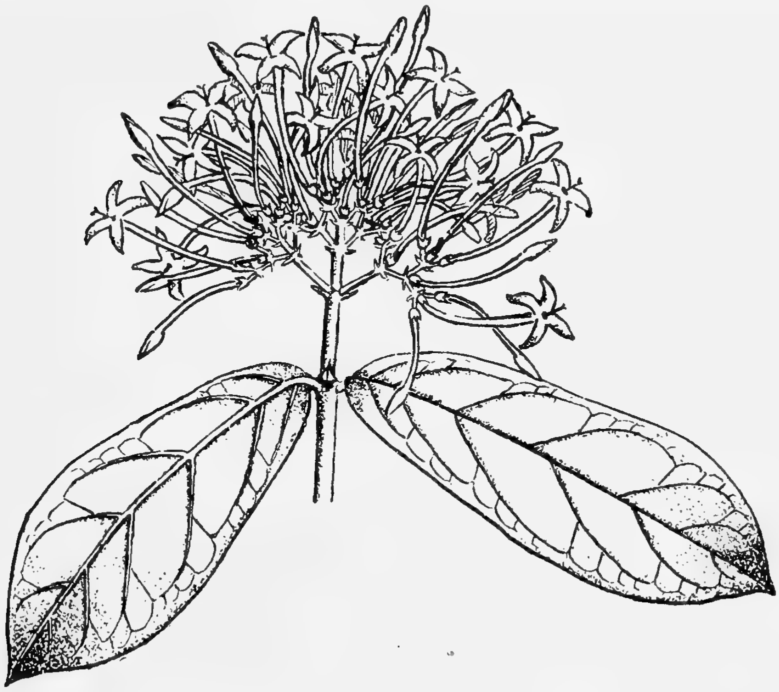


Fig. 1.—*Ixora rosea* Wall. × ½.

Description.—An untidy straggling shrub scarcely reaching 4 ft. in height at Dehra. Older stems covered with a slate-grey brown

glabrous bark, younger plants dark green, covered with a fine downy pubescence. Leaves subsessile, oblong, elliptic, elliptic-obovate in shape, obtuse or somewhat acute at the tip, rounded or slightly cordate at the base, coriaceous in texture, glossy green above, pale below, glabrous; stipules triangular, awned, pubescent.

Inflorescence peduncled; peduncles supported at the base by small bracts. Flowers shortly pedicelled, each with a pair of bracteoles below the calyx. Calyx about .1 in. long, urn-shaped, minutely pubescent, lobes .05 in. long, obtuse, tinted with red. Corolla hypocrateriform; tube 1.25, rose-coloured, minutely hairy, ending above in four elliptic-obtuse lobes, .3 in. long. Stamens 4; filaments .05 in. long, attached to the throat, alternate with the lobes; anthers .15 in. long, closely appressed to the style in the bud, reflexed in the fully opened flower. Ovary inferior, 2-celled; ovule 1 in each cell.

Flowers.—August-September. The shrub seldom fruits in Dehra.

Distribution.—According to Roxburgh it is a native of the Moluccas and China. Now widely cultivated in various parts of India.

Gardening.—An untidy straggling shrub with pink flowers in large round corymbs. It is hardly attractive when in flower, and far from being so at any other time of the year. Propagated by layers or cuttings during the rains.

Ixora parviflora Vahl.

Small-flowered Ixora.

(*parviflora* means small-flowered in Latin).

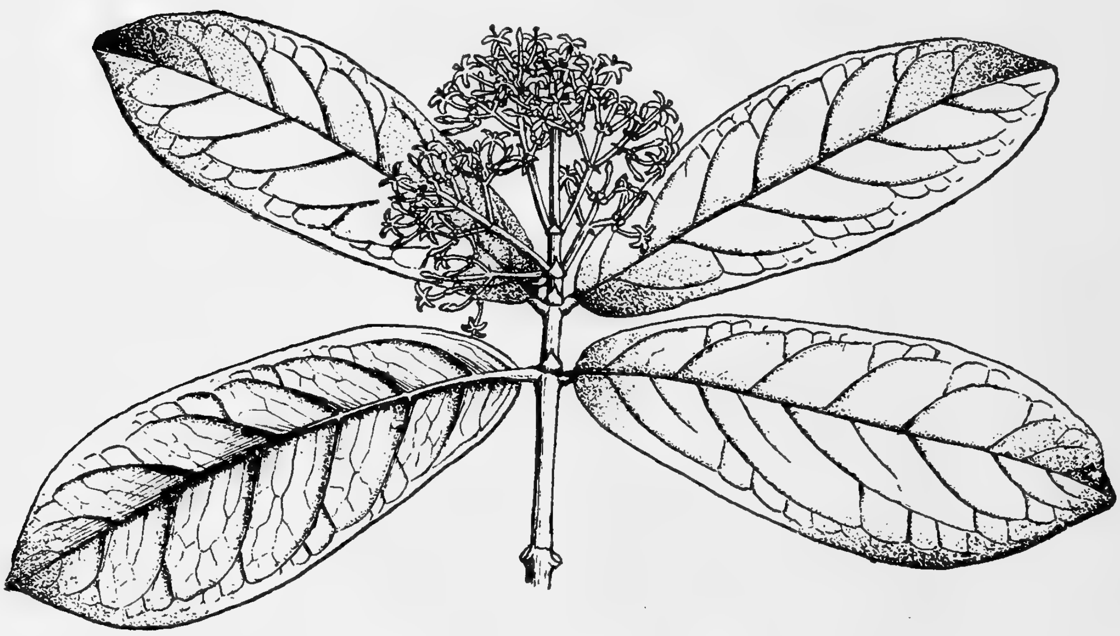


Fig. 2.—*Ixora parviflora* Vahl. × 3/8.

Description.—A small, much-branched tree; bark thick, reddish brown, exfoliating in irregular patches; branchlets slightly compressed, glabrous. Leaves opposite, stipulate, ovate-oblong or slightly obovate, 3-4 in. long, by 1.5-2 in. wide, coriaceous, glabrous,

Photo by *B. N. Bakshi*

Small-flowered Ixora (*Ixora parviflora*, Vahl.)
New Forest, Dehra Dun.

dark green and shining above, pale when dry, rounded at the base, suddenly and shortly acuminate; venation pellucid, reticulate; petioles short and stout; stipules short, cuspidate, persistent.

Flowers white, sweet scented, in sub-globose clusters, arranged in sessile, brachiate, pubescent or glabrous cymes with 3-5 pairs of opposite short branches; bracts and bracteoles subulate. Calyx minute, cup-shaped; lobes 4, very small, much shorter than the tube, subacute. Corolla tube short, glabrous .3-.4 in. long, 4-lobed; lobes linear-oblong, obtuse, ellipsoid in the bud, reflexed in the open flower. Stamens 4, alternate with the corolla lobes; filaments absent; anthers sessile, nearly as long as the lobes of the corolla. Style densely pubescent ending above in two exserted stigmatic lobes. Fruit globose, .25 in. long.

Flowers.—March-April. *Fruits.*—Cold season.

Distribution.—Native of the Western Peninsula, extending north to the Satpura range, Behar, Chota Nagpur, Orissa, Sunderbans, Chittagong, Burma and Nicobars.

Gardening.—A small much-branched tree which bears in March-April, dirty-white strongly sweet scented flowers in profusion. It can hardly be said to be attractive at any period of the year. Easily raised from seed or layers or cuttings.

Economic uses.—Wood very heavy, hard, fine grained, yellow. It is used for turney and furniture in Madras, but, as it never reaches any size, its use is restricted. The green branches are said to make excellent torches.

Ixora barbata Roxb.

Bearded Ixora.

(*barbata* means 'bearded' in Latin and refers to the woolly mouth of the corolla).

Description.—A large glabrous shrub. Trunk hardly any; branches numerous, opposite. Leaves opposite, short-petioled, elliptic or oblong in shape, somewhat acute, entire, shining on both surfaces, smooth, 6-9 in. long. The upper pairs of leaves are much smaller and are sessile and cordate. Stipules sheathing.

Inflorescence of terminal panicled corymbs, decompound, large, diffuse, often 1 ft. across. Bracts and bracteoles decreasing in size upwards, ovate, acute. Calyx globose or ovoid, reddish green, adherent to the ovary, 5 lobed; lobes small, erect, acute. Corolla tube 1.5 in. long, slender, somewhat curved, greenish white, encircled at the mouth with a delicate fringe of hairs, 5-lobed; lobes obovate, pure white in colour, obtuse, reflexed when the flower is fully open. Stamens 5, alternate with the lobes; filaments short, recurved, so that the linear anthers hang down between the lobes. Style long slender, exserted, glabrous. Stigma club-shaped, divided into two short stigmatic arms. Berry red, smooth, the size of a pea, 2-seeded.

Flowers.—April-May. *Fruits.*—Cold season.

Distribution.—Native of the Andamans and Nicobars. Commonly cultivated at Calcutta and elsewhere in India.

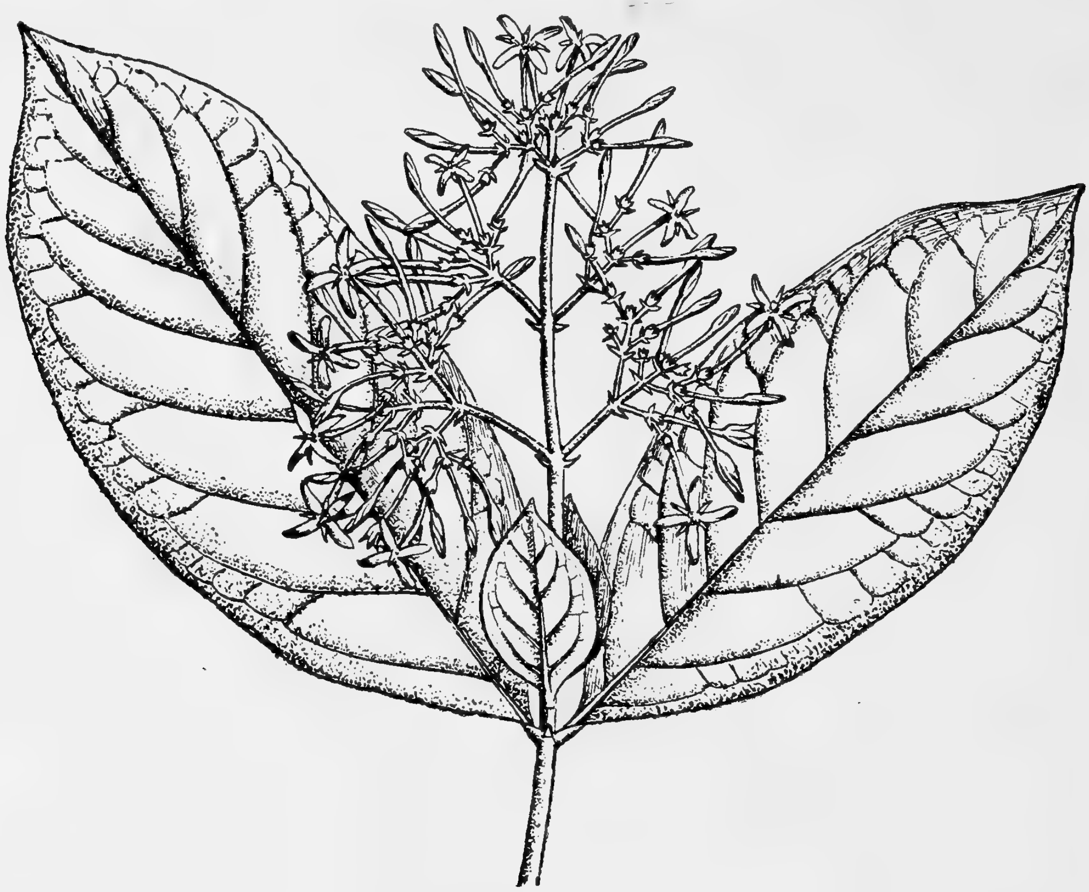


Fig. 3.—*Ixora barbata* Roxb. × 3/8.

Gardening.—A large glabrous shrub with rich deep green leaves. It produces during the hot season large, lax corymbs of long-tubed, white, fragrant flowers. Easily raised by layers or cuttings.

Ixora chinensis Lam.

Chinese Ixora.

(*chinensis* refers to the country of origin of this plant).

Fig. 4.—*Ixora chinensis* Lam. × ½.

Description.—A small shrub 3-4 ft. tall, with straight branches covered with smooth dark-brown bark. Leaves opposite, stipulate,

subsessile, obovate or obovate-oblong, entire, smooth on both surfaces, 5-6 in. long. Stipules interpetiolar, tapering, acute.

The inflorescence is terminal and consists of dense corymbs; branches of the inflorescence trichotomous, smooth, glabrous, reddish. Calyx tube adnate to the ovary, globose or ovoid, small, 4-lobed; lobes short, obtuse, reddish. Corolla tube cylindrical, slender, .75-1 in. long, 4-lobed; lobes almost orbicular. Stamens 4, alternate with the lobes; filaments short, inserted at the mouth of the corolla; anthers linear-acute, reflexed. The colour of the flowers is at first orange, becoming a deeper and deeper salmon-red as the flowers become fully open. Style exserted; stigma 2-cleft; lobes reflexed. Berry smooth succulent, red, 2-celled, with a single rugose seed in each cell.

Flowers.—July-September. Does not set fruit in this country.

Distribution.—Indigenous to the Malay Archipelago and China, now commonly grown in gardens in all tropical countries.

Gardening.—A shrub closely allied to *I. coccinea* and commonly cultivated in gardens for its showy rose-red flowers. Propagated by cuttings during the rains.

Economic uses.—According to Burkill a decoction of the roots of this plant is used after child birth by the Malays.

Ixora undulata Roxb.

Wavy-leafed Ixora.

(*undulata* means wavy in Latin and refers to the margins of the leaves).

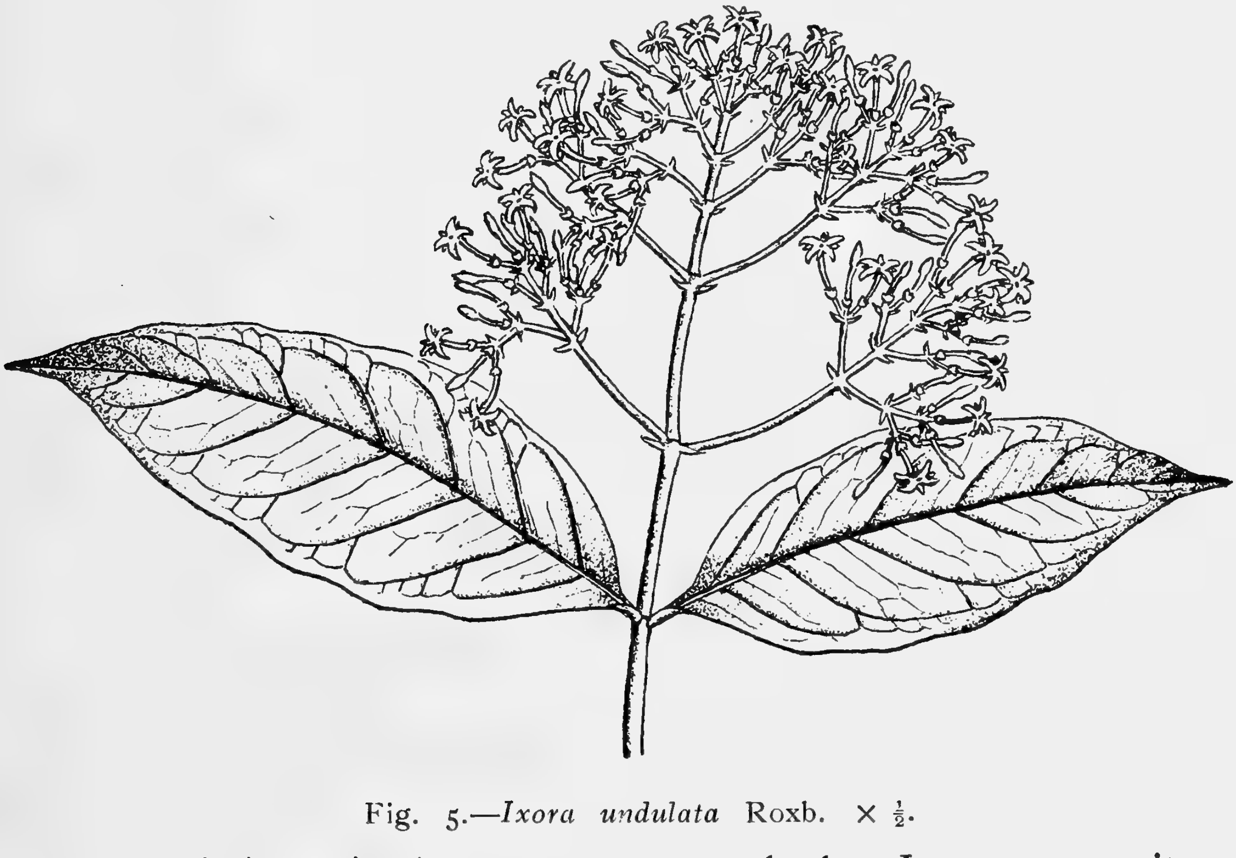


Fig. 5.—*Ixora undulata* Roxb. × ½.

Description.—A large evergreen shrub. Leaves opposite, subsessile or distinctly petioled, stipulate, oblong or lanceolate in

shape, 5-9 in. long by 1.5-3.3 in. wide, glabrous, usually tapering at both ends, acute or acuminate at the tip; margins undulate. Stipules interpetiolar, broad and rounded, ~~but~~ with a slender cusp.

Flowers white, sweet-scented, corymbs on the slender branches of long-pendunceled brachiate panicles which are up to 8 in. long. Calyx tube very short, 4-toothed; lobes acute as long as the tube. Corolla tube .28-.32 in. long, white, 4-lobed; lobes .16-1.8 in. long, reflexed. Stamens 4; filaments short; anthers 2-cleft at the base. Style exserted from the tube, ending in two recurved stigmatic arms. Fruit succulent, .3 in. diameter, dull purple or slate-coloured with two plano-convex seeds.

Flowers.—March-April. *Fruits.*—Cold season.

Distribution.—Sikkim Terai and lower hills of Bhutan, Assam, Khasi hills and upper Burma.

Gardening.—A large evergreen shrub which produces in March-April, numerous small white flowers having a powerful fragrance of jasmine. Easily propagated by seed or cuttings or layers.

Ixora fulgens Roxb.

(*fulgens* is a Latin word meaning gleaming or shining and refers to the scarlet flowers).

Fig. 6.—*Ixora fulgens* Roxb. × $\frac{3}{8}$.

Description.—A short-trunked shrub dividing into many branches covered with dark brown bark. Leaves opposite, short-petioled, entire, smooth on both surfaces, linear oblong to obovate-oblong in shape, acute at the tip, 6-8 in. long, 1-3 in. wide, with 20-30 pairs of nerves sunk in the upper surface. Stipules inter-petiolar, awned.

Flowers in large terminal cymose corymbs, composed of short decussate, highly-coloured slender branches and branchlets, ending in numerous short-pedicelled, long-tubed, orange-scarlet or scarlet flowers. Calyx tube adnate to the ovary, very short, 4-lobed;

lobes obtuse. Corolla tube very slender, up to 1.75 in. long, cylindrical, glabrous, 4-lobed; lobes obovate, obtuse, .25 in. long, reflexed. Stamens 4, alternate with the lobes; filaments short. Style slender exserted; stigmas 2. Berry 2-lobed, the size of a pea, deep purple when ripe, 2-celled.

Flowers.—Most of the year. Does not fruit in this country (?).

Distribution.—Native of Tenasserim. Widely cultivated throughout the tropics.

Gardening.—A highly ornamental and elegant shrub which bears corymbs of numerous long-tubed, pretty, large, scarlet flowers. Easily multiplied by cuttings.

Ixora lutea Hutch.

Yellow Ixora.

(*lutea* means yellow in Latin).

Fig. 7.—*Ixora lutea* Hutch. × $\frac{3}{4}$.

Description.—An erect shrub reaching 3 ft. in height; branchlets covered with a fine pubescence, finally glabrous. Leaves opposite, stipulate, oblong-elliptic in shape, acute at the tip, unequally cordate at the base, 3-4 in. long by 1.5-2 in. wide, papyraceous in texture with a slightly recurved margin, pale green in colour; petiole stout, .75 in. long, minutely pubescent. Stipules up to .5 in. long, awned.

Inflorescence a terminal, lax corymbose cyme of sessile flowers; branches puberulous; bracts triangular-subulate, acute. Calyx-tube short, 4-lobed; lobes broadly ovate, about .1 in. long, finely puberulous outside. Corolla ochre-coloured; tube cylindric, 1.5 in. long, very slender, glabrous outside, 4-lobed, lobes ovate-rhomboid, acute, up to .75 in. long, toothed, glabrous. Stamens 4, almost sessile,

dark orange in colour; anthers acutely acuminate. Ovary 2-celled; style slender, glabrous, shortly exserted, arms about .1 in. long, slightly recurved and flattened on the inner surface.

Flowers.—Practically throughout the year. Does not set seed in this country.

Distribution.—Widely cultivated throughout the tropical and subtropical parts of the world. A plant of garden origin.

Gardening.—This beautiful Ixora, which in habit and foliage bears a close general resemblance to *I. coccinea,* can readily be distinguished from it not only by the colour of its flowers, but also by its laxer inflorescence and by the large ovate-rhomboid corolla lobes. It was introduced into the Royal Botanic Garden, Kew, from Peradeniya. It is an exceedingly attractive plant when in flower, and will flourish under moist tropical conditions. Raised by layers or cuttings.

5. **Coffea** Linn.

The generic name is derived from the Arabic name, 'Kahwa', for the drink, itself supposed to be from Caffa, a district in southern Abyssinia.

Small bushy shrubs with opposite stipulate leaves. Flowers yellowish or white, in axillary or terminal fascicles or in solitary or axillary dense cymes. Hypanthium short, calyx tube short or absent, often glandular and persistent; sepals minute or absent. Corolla tube short or long with 4-7 spreading lobes twisted in the bud. Anthers 4-7 sessile, often recurved or twisted. Ovary 2-celled, style filiform with 2 linear or subulate branches. Ovules 1 in each cell attached to a peltate placenta on the septum. Fruit a drupe with 2 plano-convex or vertically concave coriaceous or cartilaginous seeds.

Coffea bengalensis Roxb.

(The specific name refers to the home of the plant).

Description.—A slender deciduous shrub with spreading branches. Young shoots compressed, grey-pubescent, soon glabrous and covered with a greyish bark. Leaves opposite 1.5-4.5 in. long, by .5-2.5 in. wide, broadly ovate or elliptic in shape, obtuse at the tip, acuminate or subcaudate, rounded or acute at the base, dark green above, pale below, membranous; petiole up to .16 in. long.

Flowers appearing with the leaves, axillary in groups of 1-3, white, sessile, fragrant, 1-1.5 in. across. Calyx tube short, many-toothed, pubescent; teeth rapidly deciduous. Corolla funnel-shaped. .5-.7 in. long, 5-lobed; lobes ovate-oblong, slightly shorter than the tube, spreading or recurved, twisted in the bud. Stamens 5, alternate with the lobes, inserted in the mouth of the corolla tube, subsessile. Ovary 2-celled; ovules solitary in each cell. Style filiform, bifid. Fruit oblong, black when ripe, containing 2 planoconvex seeds.

Sweet Smelling Rondeletia
RONDELETIA ODORATA Jacq.
($\frac{9}{10}$ nat. size.)

The seed contains the alkaloids found in the true coffee plant, *C. arabica* L.

Fig. 8.—*Coffea bengalensis* Roxb. × $\frac{3}{4}$.

Flowers.—Feb.-April. *Fruits.*—Cold season.

Distribution.—Tropical Himalaya from Garhwal eastwards to Sikkim and Assam; also in Chittagong, central and south India, and Burma extending to Siam and Java.

Gardening.—A small shrub, exceedingly beautiful when in full bloom during February, with its snow-white flowers produced in great profusion. Propagated by seed.

6. **Rondeletia** Linn.

(A genus erected by Linnaeus in honour of Guillaume Rondelet, a French naturalist, who died in 1566).

This genus contains evergreen shrubs or trees. Leaves opposite, sessile or petiolate, stipulate, sometimes ternately whorled, coriaceous, chartaceous or membranous. Inflorescence of terminal or axillary corymbose cymes. Flowers coloured, white, red or yellow,

Calyx adnate to ovary, shortly lobed. Corolla hypocrateriform; tube slender, usually short, glabrous or bearded in the throat; limb 5-lobed; lobes rounded. Style slender; stigmas exserted or included. Ovary 2-celled. Fruit a capsule.

Rondeletia odorata Jacq.

Sweet-smelling Rondeletia.

(*odorata* means sweet-smelling in Latin and refers to the fragrance of the flowers).

Description.—A shrub reaching 6 ft. in height; young parts covered with a setose pubescence. Leaves opposite, stipulate, ovate or elliptic-ovate in shape, subacutely acuminate, cordate or rounded at the base, 3-7 in. long, 1-3.5 in. wide, entire, chartaceous, the younger sparsely pilose on the nerves, at length glabrous, ciliate; petiole about .12 in. long, setosely pilose. Stipules persistent, interpetiolar, ovate-lanceolate, obtuse or acute, coriaceous, up to .5 in. long, covered with appressed pubescence.

Inflorescence of many-flowered, terminal, corymbose cymes up to 5 in. diameter; bracts ovate-lanceolate, obtuse or subacute, up to .5 in. long, coriaceous, densely appressed pilose on the outer surface; bracteoles small. Calyx campanulate, .05 in. long, puberulous outside, with short obtuse lobes. Corolla with a cylindric tube .3 in. long, reddish-orange in colour, puberulous outside, pilose within, 5-6-lobed; lobes .25-.3 in. long, oblong with rounded tip, rose-coloured. Stamens as many as the corolla lobes and alternate with them; filaments short attached in the corolla throat about the centre of the tube; anthers .05 in. long. Style shorter or longer than the tube, 2-lobed, glabrous. Capsule subglobose, slightly 2-lobed, hairy.

Flowers.—Hot and rainy season. *Fruits.*—Cold season.

Distribution.—A native of the West Indies and Mexico, now commonly cultivated in the tropics of the whole world.

Gardening.—A handsome, small, hardwooded shrub about 3 ft. high. It bears beautiful orange-scarlet flowers in constant succession, through the hot and dry seasons. The faded flowers remain on the plant for a long time giving it an unsightly appearance and should, therefore, be removed quickly. Propagated by layers during the rains, but it usually takes 3-4 months before they are ready for removal.

7. **Hamelia** Jacq.

(This genus was named in honour of H. L. du Hamel de Monceau, 1700-1782, a French botanist).

Shrubs with slender, glabrous or pubescent branches. Leaves opposite or in whorls of 3 or 4, petiolate, membranous. Stipules lanceolate, subulate, deciduous. Inflorescence in di- or tri-chotomous branched terminal cymes. Flowers shortly pedicellate. Calyx ovoid

Photo by *M. N. Bakshi*

Sweet-smelling Rondeletia (*Rondeletia odorata,* Jacq.)
New Forest, Dehra Dun.

Photo by *M. N. Bakshi*

Sweet-smelling Rondeletia (*Rondeletia odorata*, Jacq.)
New Forest, Dehra Dun.

Photo by *M. N. Bakshi*

Hamelia patens, Jacq.
New Forest, Debra Dun.

Photo by M. N. Bakshi

Hamelia patens, Jacq.
New Forest, Dehra Dun.

or top-shaped, 5-lobed. Corolla tube cylindrical, 5-lobed; lobes imbricate in the bud. Stamens 5, inserted at the base of the tube; filaments very short; anthers fixed by the base, narrowly linear, appendaged at the apex. Ovary 5-celled; style filiform; stigma narrowly fusiform, grooved, somewhat twisted. Ovules numerous. Fruit a berry crowned by the remains of the disk.

Hamelia patens Jacq.

(*patens* means spreading in Latin and refers to the habit of the species).

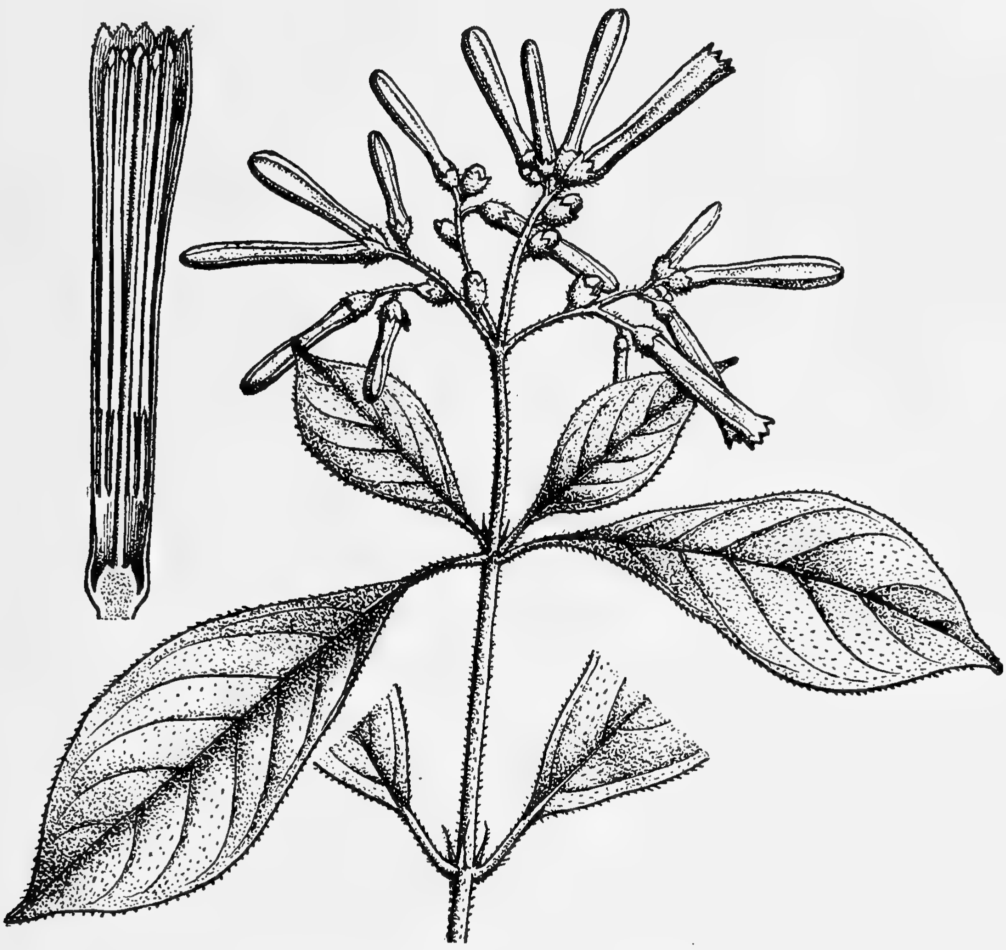


Fig. 9.—*Hamelia patens* Jacq. × $\frac{3}{4}$.

Description.—A shrub or small tree; branches reddish, covered with a short crisped pubescence, quadrangular when young, afterwards rounded. Leaves stipulate, petiolate, up to 5 in. long by 2.5 in. wide, elliptic or oblong in shape, narrowed at both ends, olive green above, paler beneath, hairy on both surfaces, membranous, opposite or in threes; nerves 6-9 pairs, prominent and often tinged with red beneath; petiole .5 in. long, reddish, hairy; stipules broad at the base, produced into a stout linear awn.

Inflorescence terminal, in cymes up to 3 in. long; principal axis short; secondary axis up to 1 in. long bearing 3-5 flowers arranged in a bostryx or scorpioid cyme. Pedicels very short. Bracteoles minute. Calyx tube adnate to the ovary, campanulate, reddish in

colour, produced above into 5 minute lobes, covered with very short hairs. Corolla tube cylindrical, .8 in. long, slightly attenuate just above the base, cylindrical, ridged (the ridges corresponding to the 5 lobes) shortly pubescent all over, 5-lobed; lobes very short, valvate in the bud. Stamens 5; filaments attached near the base of the tube, short; anthers about .5 in. long, linear, acute at the tip, bifid at the base, included in the corolla tube. Ovary 5-celled, surmounted by a thick conical disk; style 1 in. long. Berry ellipsoid, .25 in. long, surmounted by the fleshy disk.

Flowers.—Hot and rainy seasons. *Fruits.*—Cold season.

Distribution.—Indigenous to tropical America; now commonly cultivated throughout the tropics.

Gardening.—A large evergreen shrub, prized for the profusion of sprays of orange-red flowers. The flowers are succeeded by handsome blood-red berries, which are retained a long while on the plant. Numerous sun-birds visit the pipe-like flowers from morning till evening to extract the nectar. It is advisable to prune the plant heavily to keep it within bounds. Easily propagated by cuttings or by seed.

8. **Hamiltonia** Roxb.

(This genus was erected in honour of William Hamilton of Woodland, Philadelphia, an eminent American botanist of the nineteenth century. He was the first to build a conservatory in America so that tropical plants could be grown in a cold climate.)

Erect shrubs, foetid when bruised, with prominently nerved leaves and interpetiolar acute persistent stipules. Flowers small, sweet scented, arranged in terminal panicles or sub-umbellate cymes. Calyx ovoid, 4-5 lobed; lobes subulate, often glandular, persistent. Corolla funnel-shaped with a long tube, 4-5-lobed; lobes valvate. Stamens inserted in the throat, filaments short, anthers obovate-oblong. Ovary 5-furrowed, almost free from the calyx, 5-celled, finally 1-celled by absorption of the septa. Style filiform; stigmatic lobes 5, linear. Ovules 1 in each cell, basal. Fruit a capsule, 1-celled, 5-valved. Seeds triquetrous.

Hamiltonia suaveolens Roxb.

(*suaveolens* means sweet-smelling in Latin).

Description.—Stem stout, shrubby, with ash-coloured bark covered with purple specks, reaching a height of 10 ft. Leaves opposite, 3-6 in. long, broad-lanceolate in shape, smooth, entire short petioled. Stipules interpetiolar, ensiform.

Flowers sessile in terminal corymbiform heads, on short trichotomous branches, pure white or mauve, delightfully scented, supported by linear glandular-villous bracts and bracteoles. Calyx tube ovoid; lobes 4-5, subulate, .1 in. long, covered with gland-tipped hairs. Corolla tube slender, .5-.6 in. long, 4-5-lobed; lobes 4-5, oblong-obtuse, valvate in bud. Stamens 4-5; filaments very

Photo by

M. N. Bakshi

Hamiltonia suaveolens Roxb. (cultivated form)
New Forest, Dehra Dun.

Photo by *M. N. Bakshi*

Hamiltonia suaveolens Roxb. (cultivated form)
New Forest, Dehra Dun.

short, inserted in the throat of the corolla and alternate with the lobes. Ovary 5-furrowed, almost free from the calyx, 5-celled, but becoming 1-celled from absorbtion of the septa; ovules 1 in each cell, basal. Fruit a 1-celled capsule, 5-valved at the apex, 5-1-seeded.

Fig. 10.—*Hamiltonia suaveolens* Roxb. × $\frac{3}{4}$.

Flowers.—Cold season. *Fruits.*—May-June.

Distribution.—Sub-Himalayan tract and outer hills from the Punjab to Bhutan, ascending to 6,500 ft., Behar, and Western Peninsula.

Gardening.—A large, stout shrub with lavender blue or whitish, sweet-scented flowers which are freely produced during the cold weather. It prefers a sheltered situation, and is greatly improved by being well cut in after flowering. Propagated by cuttings. The fragrant flowers are much frequented by Hummingbird Hawk-moths.

Medicinal uses.—A decoction of the root is said to be valuable in dysentery and cholera.

9. **Catesbaea** Linn.

(A genus erected by Linnaeus in honour of an English Botanist, Mark Catesby, 1679-1749, traveller and naturalist).

Spinescent shrubs or small trees, with terete twigs and small, glabrous, often fascicled leaves. Stipules small, deciduous. Flowers

white, solitary and short-pedicelled in the axils. Calyx subcampanulate with 4 narrow subpersistent lobes. Corolla funnelform or campanulate, 4-lobed; lobes valvate. Stamens 4, attached near the base of the corolla. Ovary 2-celled; ovules few or many. Stigma 2-lobed. Fruit a berry.

A small genus of about 8 species.

Catesbaea spinosa Linn.

Prickly-apple; Spanish Guava.

(*spinosa* means spiny in Latin).

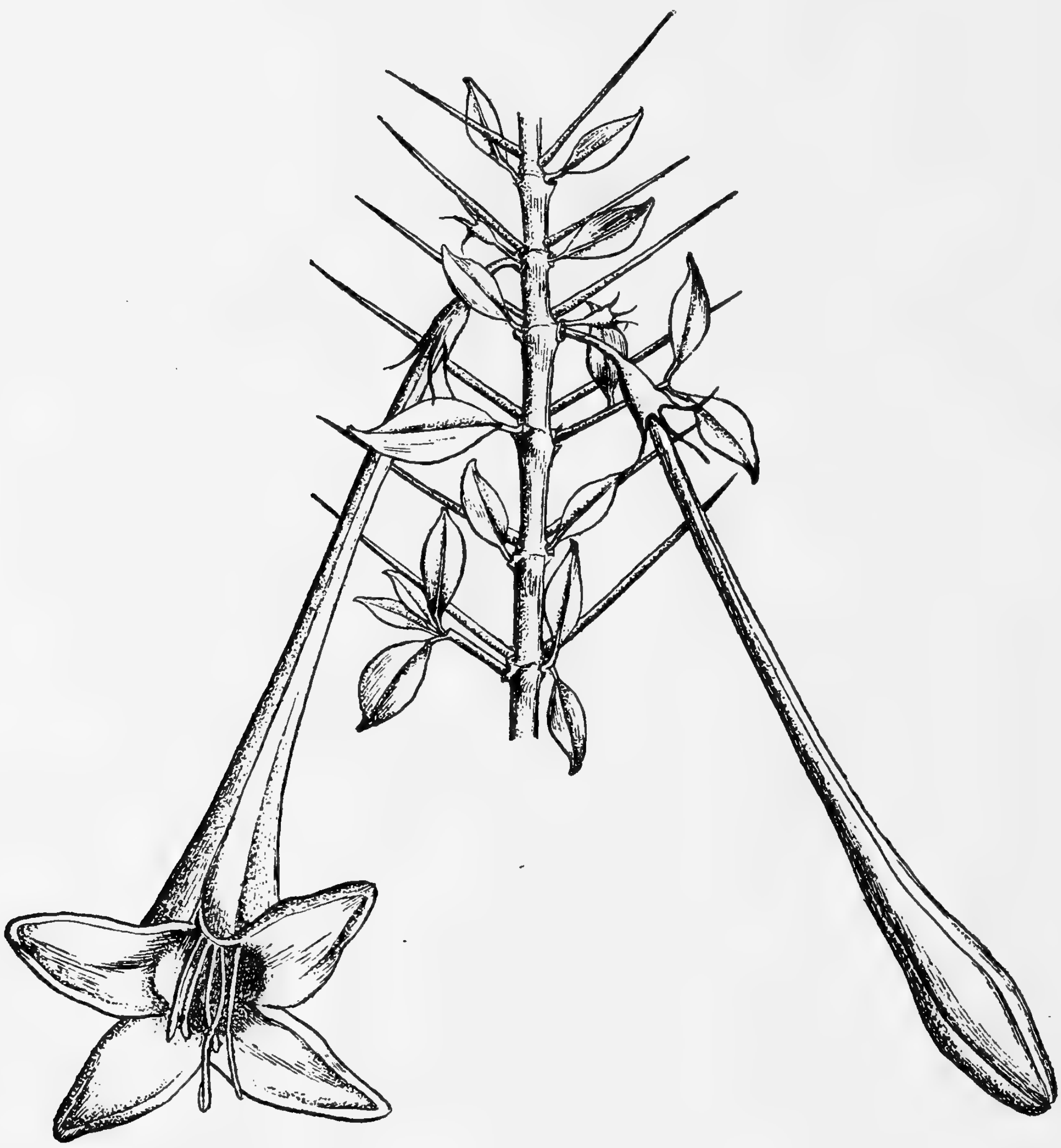


Fig. 11.—*Catesbaea spinosa* Linn. × ¾.

Description.—A spinescent shrub reaching 4 ft. in height at Dehra. Old branches covered with corky bark, younger terete, green, minutely pubescent; spines axillary, opposite, stout, sharp, .5-1 in. long, pubescent, becoming glabrous. Leaves opposite, shortly petioled, stipulate, thin or somewhat fleshy, entirely glabrous and smooth, attenuate at the base into the short petiole, apiculate at the tip, ovate-elliptic, elliptic or orbicular in shape, entire,

glossy or dull green, .25-.5 in. long; nerves inconspicuous; petiole very short; stipules interpetiolar, membranous, pubescent, rapidly deciduous.

Flowers solitary in the axils, pedicelled; pedicel .1 in. long, tinged with red. Calyx adnate to the ovary, green, sometimes reddish, oblong-campanulate, 4-lobed; lobes subulate. Corolla tube-funnel shaped, white turning yellow with age, 4-angled at the base, 3-4 in. long, pendulous, sparsely hairy outside, hairy and glandular inside, 4-lobed; lobes triangular, acute, valvate in the bud, .75 in. long. Stamens 4-5; filaments very long, attached at the very base of the corolla, rather stout, stiff, glabrous, attenuate at the tip; anthers linear somewhat less than .5 in. long, divided at the base, apiculate at the tip. Ovary 2-celled. Style slender, long, 2-lobed. Fruit up to 2 in. long.

Flowers.—May-July. It seldom fruits in this country.

Distribution.—Indigenous to the West Indies, now commonly grown in gardens throughout the plains of India.

Gardening.—A rather slow-growing, hardy, armed shrub about 4-5 ft. high. The creamy-white pendent flowers which are 3-4 in. long are outsize in proportion to the rest of the plant. Propagated by cuttings during the rains.

NEW LEPIDOPTERA FROM S. W. IRAN.

BY

E. P. WILTSHIRE, F.R.E.S.

(*With a plate*).

There were over 25% species new to science in the list of lepidoptera collected by Fred Brandt in March-September 1937 in Fars, S. W. Iran, and described by W. Brandt in the Ent. Rundschau (1938-9), many of the new species being peculiar to the southern end of the Zagros range. A similar proportion was therefore to be expected in species taken by myself in October-November 1940 in the same district, and a study of my material shews that this expectation was not disappointed. New species were also found earlier in 1940, which had escaped the vigilance of the Baltic entomologist. Some of the new species belong to difficult genera and will require the attention of a specialist before they can be published; but the following can be introduced now. They are all figured in the accompanying plate. One or two new races from the same region are also hereunder described.

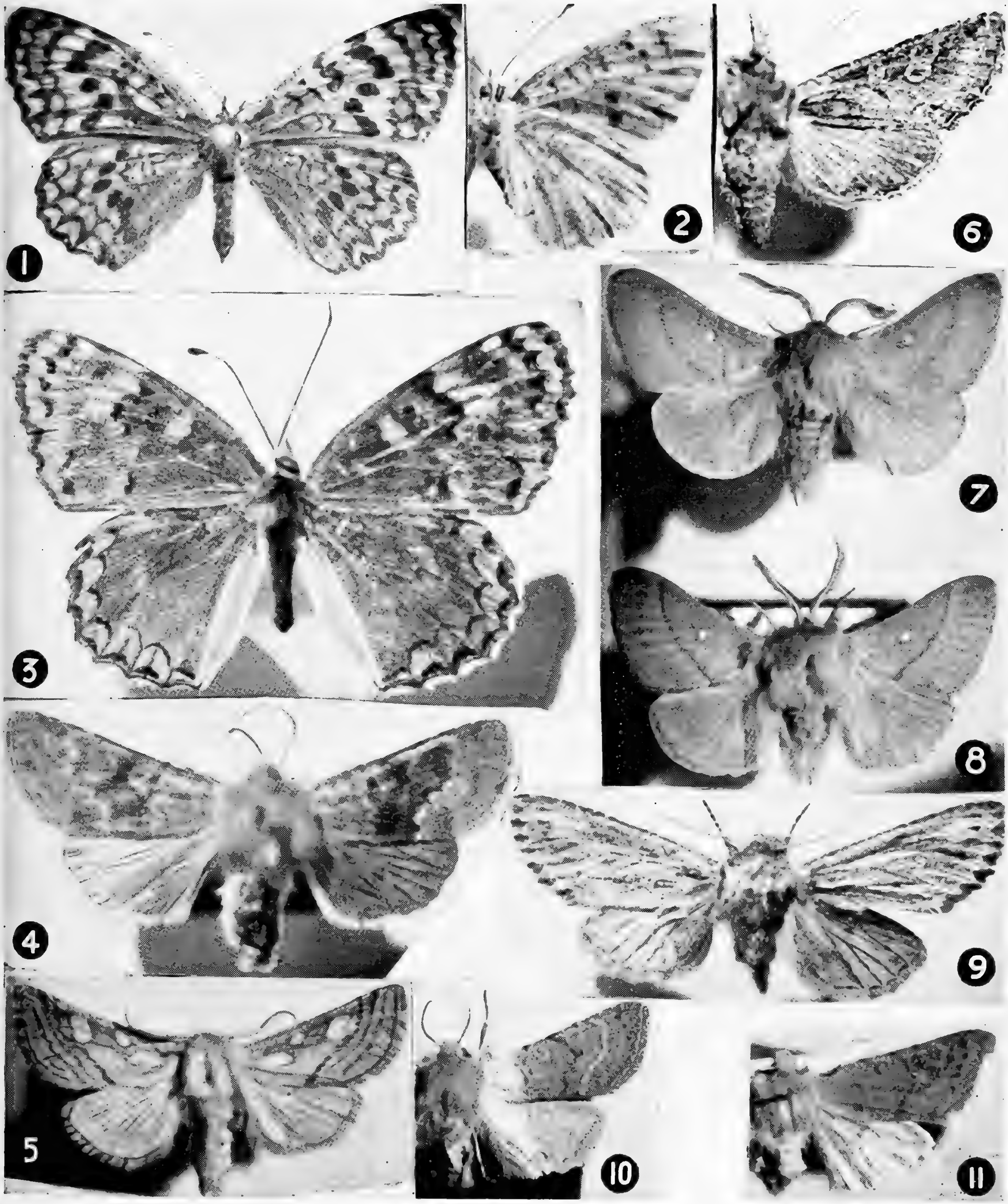
These results cannot be attributed merely to the improved communications and security of contemporary Iran which enable systematic collecting in hitherto inaccessible or insecure districts; they are due also to the peculiarity of the Southern Zagros fauna. This fauna is dual: partly it is typically Iranian; but partly it is a replica, with variations, of the Mediterranean fauna. The region is isolated on both sides by low desert tracts, and only linked faunistically by the long Zagros chain to better-known regions. The Fars mountains in fact share with the N.-W. frontier and the Teneriffe-Atlas formation the distinction of being the southernmost promontories of Palearctic woodland west of the Himalayas; and each of the three 'promontories' is isolated faunistically from the other. If, as some assert, the mountains of the interior of Iran (now quite bare) were wooded during the Pleistocene Pluvial Periods, the Fars woodlands provide a southern refuge for the relics of this woodland-fauna, perhaps more accessible than that provided in the north by the forest still clothing the north side of the Elburz range.

The following is a brief table shewing the characteristic vegetation at various altitudes along the Bushire-Shiraz-Isfahan road which makes a convenient cross-section of the southern end of the Zagros chain:

Sea-level to c. 3000 *ft.* : *Zizyphus spina-christi.*

750 *ft. upwards*: *Amygdalus,* a small spiny species.

2000 *ft. upwards*: *Pistacia* sp. & *Amygdalus spartioides.* These are the two hardiest trees and the most widely distributed. They begin in the desert hills bordering the Bushire plain and end at Qadrabad (near the site of Pasargadae). I have also been informed that a zone of scanty 'bann' (*Pistacia*) is to be found on the southern watershed of the Iranian plateau



1. *Melitaea consulis* sp. n. ♀. 2. *Melitaea consulis* sp. n. ♂ underside. 3. *Melitaea phoebe sarvistana* subsp. n. 4. *Monima mithras* sp. n. ♀. 5. *Margelana achaemenica* sp. n. ♂. 6. *Meganephria renalis* sp. n. ♀. 7, 8. *Eriogaster amygdali* sp. n. ♂♂. 9. *Brachionycha atossa* sp. n. ♀. 10. *Amathes oropotamica thermopotamica* subsp. n. ♂. 11. *Amathes oropotamica* sp. n. ♀.

The figures of the above lepidoptera are not all on exactly the same scale. Readers should consult the text for the comparative size.

south of Kerman and extends into Baluchistan. It seems doubtful whether many other of the Fars trees accompany this tree so far east.

Local at 3000 ft. upwards: *Quercus persicus, Prunus* sp. *Local at 3000-4000 ft.* : carob (*Ceratonia*). The oak is not found above 9000 ft., and has suffered heavily from deforestation, which still proceeds apace. Its thickest growth is at 4000-8000 ft., as at Mian Kotal, Pir-i-Zan. A secondary growth at Shul shows that an oak forest once grew there which probably extended formerly as far as Shiraz at least.

4000 *ft. upwards* : Wild fig, *Rhamnus* sp.

Local at 6000-8000 *ft.* : *Fraxinus* sp.

6000 *ft. upwards* : *Amygdalus,* a robuster spiny species; *Crataegus* sp., *Berberis* sp., *Lonicera persica, Colutea* sp., *Acer* sp., etc. This fauna is widespread at the requisite height, extending inland as far as Qadrabad, together with the *Amygdalus* mentioned as '750 ft. upwards'.

7000-9000 *ft.* : a few large junipers, barely surviving.

The above are forest-trees, entirely dependent on local precipitation, which only occurs in winter.

The oasis trees are as follows:

Sea-level to 3000 *ft.* : palm, tamarisk, willow, *Populus euphratica,* and various cultivated trees.

4000-6000 *ft., river beds* : willow, oleaster (*Elaeagnus*), tamarisk. *In gardens* : oriental plane, ash (*Fraxinus sp. al.*), sycamore, elm, poplar, cypress, citrus and other fruits.

Descriptions of New Species and Races

Melitaea consulis sp. n. (figures 1, 2).

An interesting new species in the *collina*-group, coming close to but distinct from *turcomanica* Higg., according to Higgins who has examined a para-type.

♂, fore-wing, same size and colour as *cinxia amardaea* Gr. Gsh. from Elburz, with white-chequered fringe, black margin, and two parallel chevrons as in *cinxia.* The median band consists of seven heavy black spots, the four nearest the costa being joined, the lower three almost or quite separate, the lowest of all being crescent-shaped, its convex side outward. Spots nos. 5 & 6 are conspicuous and oval-oblong, not (as in *phoebe*) more lightly indicated than the others. Rest of forewing, not unlike that of an ordinary form of *phoebe.* The basal fuscous suffusion extends somewhat along the inner margin. Hind-wing, like an ordinary *phoebe,* except that in all but one example the median band consists of a complete series of heavy black spots. The fuscous basal suffusion extends along the whole anal margin, leaving no pale patch as in *phoebe.* There are no dots between the nervures as in *cinxia.*

Underside, most peculiar: fore-wing: fringes and marginal area outside the proximal of the two chevrons, suffused with olive sulphur; the proximal, not the submarginal, chevron is usually the heavier. Median band, corresponding to upper side. Hind-wing: markings obsolescent, the whole wing being suffused with olive sulphur. In the few examples where the markings are traceable, there are no black marks at all on the pale median band, though other black markings do appear.

Besides the underside differences just described, the following points separate it from *collina* Led.: the median spots on the upper forewing are heavier, and the nervures are black outwards only from the proximal of the two chevrons; on the hindwing, the two parallel chevrons are closer together in *consulis.*

♀, slightly larger than the ♂, with a paler ground-colour between the median band and the proximal chevron. *Holo-type:* ♂, *Allo-type,* ♀, *Para-types,* 4♂, 3♀.

All were taken on 3-v-40, at 8000-9000 ft. on a mountain close to Shiraz, and are in coll. mea. One other para-type has been sent to the British Museum, London.

Melitaea phoebe Knoch. **sarvistana** subsp. n. (figure 3)

A more normal form of this well-known species flies in Fars northwards and westwards from Shiraz, but this more southerly race seems to be an extreme development of *dorae* Graves, described from Transjordan.

Upper side, coloured like *Polygonia egea*. All black markings on the forewing have disappeared except 1/terminal line and lunules, 2/submarginal chevron, which is interrupted so that its apical part encloses 5 fulvous lunules, the lower part, three. 3/costa and nearest nervure, 4/median band, which however is obsolescent, 5/cell-markings, very light. on the hind-wing the black markings are reduced to 1/terminal line and lunules, 2/complete submarginal chevron, 3/(sometimes) a few black spots representing the median band, 4/the nervure nearest the costa; the interspace, which is suffused with fuscous, also contains traces of the normal chevrons and bands which in other forms of *phoebe* traverse the whole wing. Base, fuscous-suffused.

Underside, as in *phoebe*, except that the forewing's black median spots are obsolete, while the hindwing's black-markings are, on the other hand, intensified. Expanse, 45 mm.

Holo-type and allo-type, ♂, ♀, both on 26-iv-40 near Sarvistan, south-east of the Shiraz Salt Lake. In coll. m.

N.B. Besides the two species mentioned above, six other members of the genus *Melitaea* fly in the Shiraz district.

Eriogaster amygdali sp. n. (figures 7, 8)

♂, Antenna, bipectinated.

Head, and thorax, light brown, slightly darker on the head and collar.

Forewing, light-brown, with a small white cell-spot, and a curving brown line running from 5mm. from apex to 6mm. from the inner angle, i.e. more obliquely than in *pfeifferi* Dan. Submarginal area sometimes dusted with chocolate-brown scales, with nervures paler.

Hindwing, light brown, sometimes dusted all over with chocolate-brown scales, sometimes only near the base; in the former case, a pale median line shows.

Fringes, on both wings, pale brown.

Underside, both wings, darker brown inside the median line. In the darker form, the nervures are pale and contrast more than on the upper side. Discal spot, invisible on both wings.

Expanse, 36-38 mm.

Holo-type, ♂, bred from larvae found on wild almond and *Crataegus* at 7000-8000 ft. on various mountains in Fars: hatched, 28-x-40. In coll. mea.

Para-type, ♂, to light, Sineh Sefid, 27-x-40. (c. 6500 ft.)

The ova may be found in winter on wild almond twigs, covered densely with silver-grey fur.

The larvæ may be found in April and May, but those found in the latter month are usually ichneumoned. The larvae when full-grown, are velvety-black, with white and pale brown hairs growing transversely across the back, leaving the somital joints showing black, and blackish vertical hairs. The lateral area is blue and contains a pure white, black-edged irregular line, below which a downward-growing fringe of straw-hued hairs half conceals the black-rimmed spiracles. Head, glossy black. Feet, brown-grey. The lateral area is black in the earlier instars, and the dorsal hairs, which are clearly red-brown in the earlier instars, reappear when the mature larva begins running about before pupation. The large webs are a common sight on the beautiful wild almond bushes of the Fars mountains, but healthy larvae are hard to come by. The exposed larva has a twitching habit. The cocoon is frail, and brown, and is hidden in the ground.

Monima mithras sp. n. (Figure 4)

This striking new species resembles no previously known congener, except perhaps the Kashmirian species *castaneipennis* Hamps., but comes in section I of the genus. (*Castaneipennis* itself may prove to belong to this section when its female is discovered.)

♀, Eye, large, bristly; antenna, strongly bipectinated.

Thorax, pale buff on the shoulders, infused with light brown and grey elsewhere. Head, pale buff. Forewing, buff, heavily sprinkled with grey. All markings, rather indefinite in outline. The lines are paler, brown-edged on either side. Basal line, very faint. Antemedian line, running at right-angles to the costa, with two inward angles, on vein 1 and on the cell. Median field, darker brown, the stig-

mata shewing paler. The warm brown clouding of the median field is darkest between the stigmata and close to the antemedian line. Postmedian line, dentate on the nervures. Submarginal line, running somewhat as in ***incerta,*** but very faint, and edged inwardly with light brown. Stigmata, with pale but not sharp edges, and darker centres, of average size: orbicular, round; reniform, somewhat square, convex proximally, rather vague distally. Termen, pale buff. Fringes, brown basad. Hindwing, dark grey, with termen and fringes as on forewing.

Underside, forewing, whitish buff, dusted with brownish grey. Postmedian line indicated shadowily. Hindwing whitish buff, dusted with brownish grey inside a shadowy median line.

Expanse, 42 mm.

Holo-type, ♀, 7-iv-40, Pir-i-Zan woods, attracted to wild almond flowers at night; in coll. mea.

Brachionycha atossa sp. n. (Figure 9).

The absence of black streaks between the nervures in the marginal area at once distinguishes this new species from both ***sphinx*** Hufn., and *syriaca* Warr., close to which it must be placed.

♀, Forewing, silver grey, sprinkled with black, with a lilac tinge towards the costa, and a pinkish infusion in the centre of the wing. Basal streak, black, slightly shorter than in ***sphinx.*** Orbicular stigma, represented by a short black streak, paler-edged; other stigmata, invisible. First line, absent; postmedian line, fine, black, more heavily black between veins 1 & 2, and sharply zigzagging inwards between the nervures which are dark grey. Submarginal area, clouded irregularly with dark grey, nervures 2, 3, 4, 7 & 8 being white edged as they pass through it. Terminal line, sharply white, wavy, with points at each nervure. Fringes, dark grey. Hindwing, grey, darker basally and anally, with darker nervures and terminal line, and a paler wavy median band. Fringes, grey, with white interruptions at the nervures.

Underside, forewing, grey, darker inside the zigzagging postmedian line; margin and fringes as on upper side. Cell-spot, large and dark. Hindwing, as upperside, but cell-spot more clearly marked.

Expanse, 44 mm.

Holo-type, ♀, Khan-i-Zinian, Fars, 8-xi-40 (c. 6000 ft.) in coll. mea.

Meganephria renalis sp.n. (Figure 6)

A striking new species between *tancrei* Graes. and *oxyacanthae* L. and distinguished from the latter by its stigmata which form the figures 80 on the left forewing, and also by the female antennae, which put it in the ***tancrei section*** of the genus.

♀, Antenna, bipectinated throughout.

Head and thorax, grey, speckled with black.

Forewing, light brown, heavily suffused with grey and speckled with black scales, especially on the nervures; the median fold is less grey-suffused than the adjacent costal and dorsal areas. Basal streak, black, as in ***oxyacanthae.*** Orbicular and reniform stigmata, pale silver-grey, darker-centred, with blackish edge, forming respectively an oval and a kidney-shaped figure 8. Submarginal line, as in *oxyacanthae*; other lines, absent. Termen, white, with black proximal crescents between the nervures. Fringes, grey, interrupted by white prolongations of the nervures. Hindwing, dark grey, paler basally; terminal line, white. Fringes, as on forewing.

Underside, both wings, whitish, freckled with grey, especially the forewing. Cell-spots indicated on hindwing.

Span, 43 mm.

Holo-type, ♀, 30-xi-40, Sineh Safid (c. 6500 ft.) in coll. m.

Amathes oropotamica sp. n. (Figure 11)

A new species near *lychnidis* F., from which its pale hindwing and different reniform stigma distinguish it.

♀, Antenna, slightly cetose-ciliate.

Head and thorax slightly less brown than forewing. Abdomen, pale grey with a few dark scales.

Forewing, grey brown, of similar shape to that of *lychnidis,* or if anything a trifle more pointed and narrow. Costa, paler, with three vague purple-grey smudges above the cell. First line, not reaching the costa, faintly indicated by the fine brown edging on either side; wavy, but less so than in *lychnidis.* Outer line, paler, edged with faint brown crescents between the nervures on each side. Submarginal line, pale, interrupted, marked proximally with small black smudges between veins 4 to 8; the black costal mark near the apex, typical of *lychnidis,* is absent. Terminal line, pale brown with black dots on the proximal edge. Fringes, brown, with a yellow post-terminal line. Orbicular stigma, yellow-outlined, with a grey centre, and a blue-black spot in the upper proximal corner. Reniform stigma, more truely reniform, i. e., more rounded than in *lychnidis,* yellow-outlined, centre as in orbicular, but intensified to blue-black in lower lobe. Hindwing, pale dirty grey, the nervures, termen, and cell-dot darker.

Underside, forewing much paler and less coloured than *lychnidis,* the only clear markings being the reniform stigma on the forewing, and the cell-spot on the hindwing.

Span, 39 mm.

(3000 ft.) in coll. m.

(N.B. *Amathes lychnidis* F. occurs commonly in Shiraz gardens.)

Amathes oropotamica thermopotamica subsp. n. and sp. dist. (Figure 10)

This appears to be a dwarf, desertic race of the preceding, but might prove to be specifically distinct. It occurs in a locality intermediate between the highlands of Fars and the desert coast of the Persian Gulf. Both *oropotamica* and *thermopotamica* were taken in river beds or gorges.

♂, Antenna, strongly ciliate.

Head, thorax and forewing, lilac or brownish grey, less reddish tinted than *oropotamica.* The blackish marks along the submarginal line of that species' type are here absent or obsolescent; so are the black terminal dots. The stigmata are less conspicuous though similar in form and colouring, but the orbicular is of variable intensity.

Span, 32 mm.

Holo-type, ♂, 20-xi-40, Shapur Gorge (Tang-i-Chugan), at carob-bloom, (3000 ft.) in coll. m.

Para-type, ♂, ditto..

Amathes macilenta Hbn. subsp. **plumbea** subsp. n.

An unusual colour-form of a well-known species which is yellowish in its typical form (Europe) and chestnut-red (subsp. *rubescens* Wilts.) in Syria and parts of Persia such as Kermanshah.

Head, thorax, and forewing, of a buff ground colour, more or less completely obscured with a lilac-grey suffusion. In the less heavily infused specimen, the thorax and basal part of the forewing are clearer buff. Postmedian and antemedian lines, very indistinct. Orbicular and reniform stigmata, not conspicuous, the latter being grey-filled and darker blue-grey in its lower part. Submarginal line, whitish, the brownish proximal edging not always clearly indicated. Marginal area, paler in one example. Fringes, pale brown, more or less suffused with lilac. Hindwing, dull grey, with paler buff fringes.

Holo-type, ♂, 20-xi-40, Shapur Gorge (Tang-i-Chugan), Fars, (c. 3000 ft.) (To carob-bloom.) in coll. m.

Para-types, ♂♂, ditto.

Crymodes bischoffii H. S. **zagrobia** subsp. n.

A distinctive, smaller race, characteristic of the southern, hotter part of the Zagros, of an autumnal species whose type-form occurs in the hills, from Turkey to Palestine and Kurdistan.

The forewing is more heavily suffused with dark grey, especially in the postmedian area, thereby causing the marginal area to appear strikingly paler, and emphasising the angularity of the submarginal line.

The distinctive underside (similar in both races) has not yet been described: the wavy postmedian line is neatly defined on both wings in grey, and stands out especially on the hindwing, the veins being darkened where they pass through

it. The cell-spot is always indicated on the hindwing, and often also on the forewing.

Span of *zagrobia,* 40-41 mm.

Holo-type, ♂, Khorramabad, Luristan, 29-x-38. In coll. mea.

Allo-type, ♀, Shapur Gorge (Tang-i-Chugan) Fars (3000 ft.) (To carob-bloom) In coll. mea.

Para-types, ♀♀, Khorramabad, 29-x-38. (To light). In coll. m.

Margelana achaemenica sp. n. (Figure 5)

Similar in size and colour to *flavidior* Wagn., but more elaborately marked.

♂, Antenna, canary-yellow, strongly bipectinate.

Head and thorax, canary-yellow.

Forewing, canary-yellow, suffused with light brown on the cell. Stigmata, clear canary-yellow, with brown outlines: orbicular, variable in size and shape, assuming a parallelogram-form when large; reniform, large, its inner edge being straight. A brown line along the cell joins these two stigmata. First line, absent. Second line, brown, meeting the inner margin about halfway, touching the lower edge of the reniform stigma, and running on an almost straight course across the wing, but curved slightly based between the nervures. Submarginal line, less straight than in *flavidior,* but straighter than in *versicolor,* brown, reaching neither costa nor inner margin. A brown costal shade, not reaching further than vein 3 even in the most strongly marked forms, runs between the second and the submarginal lines. There are also traces of a fine brown shade in the marginal area in some specimens. Termen, brown. Fringes, yellow. Hindwing, yellowish, plain, with brown termen.

Underside, yellow, with second line indicated on both wings by a brown suffusion, especially strong near the costa of the forewing.

♀, Antenna, simple.

Thorax, paler.

Forewing, paler and less marked usually than male.

Expanse, 35-40 mm.

Holo-type, ♂, 20-x-40, P'ir-i-Zan woods, (c. 7000 ft.) Fars, in coll. m.

Allo-type, ♀, ditto.

Para-types, ♂♂♂♂♂♂♀♀, same date and place, also at Sineh Safid (nearer Shiraz) 27-x-40. In coll. mea.

(N.B. *Margelana flavidior* Wagn. & *versicolor* Stgr. also occur with the above species).

FISHES COLLECTED BY THE VERNAY-HOPWOOD UPPER CHINDWIN EXPEDITION, 1935[1].

BY

SUNDER LAL HORA, D.SC., F.R.S.E., F.N.I., AND K. S. MISRA, M.SC.,

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(*With one plate*).

The collection dealt with in this paper was received from two sources, but originally it had formed part of a much larger collection made by the Vernay-Hopwood Upper Chindwin Expedition. In June 1938, Mr. S. H. Prater sent to the Zoological Survey of India 42 specimens of fish which the Bombay Natural History Society had received as a presentation from the American Museum of Natural History. In August, 1938, Mr. J. T. Nichols of the American Museum of Natural History, on his own initiative, sent a small consignment of 50 fishes collected by Mr. H. C. Raven of the Vernay-Hopwood Chindwin Expedition. The latter lot comprised only such forms about the identification of which there were some doubts. The major part of the collection had, however, already been named and distributed on the shelves in the Museum. Of the specimens received from the Bombay Natural History Society there were some that had been collected by the Expedition in the Malay Peninsula, but we propose to deal here only with the specimens collected from the Chindwin drainage in Upper Burma. For precise data about the various localities from which the fish were obtained reference may be made to Morris's article in the *Journal of the Bombay Natural History Society* (vol. xxxviii, pp. 647-671, 1936) in which a general account of the Expedition is given.

We are given to understand that owing to unusual field difficulties of packing and transportation, the fish material could not be looked after properly and it is not surprising, therefore, that quite a number of specimens are in a poor state of preservation. However, it has been possible to identify all of them specifically.

In the following list species represented in the collection examined by us from the Upper Chindwin area are given; the localities in which the respective species were collected and their general distribution are also included.

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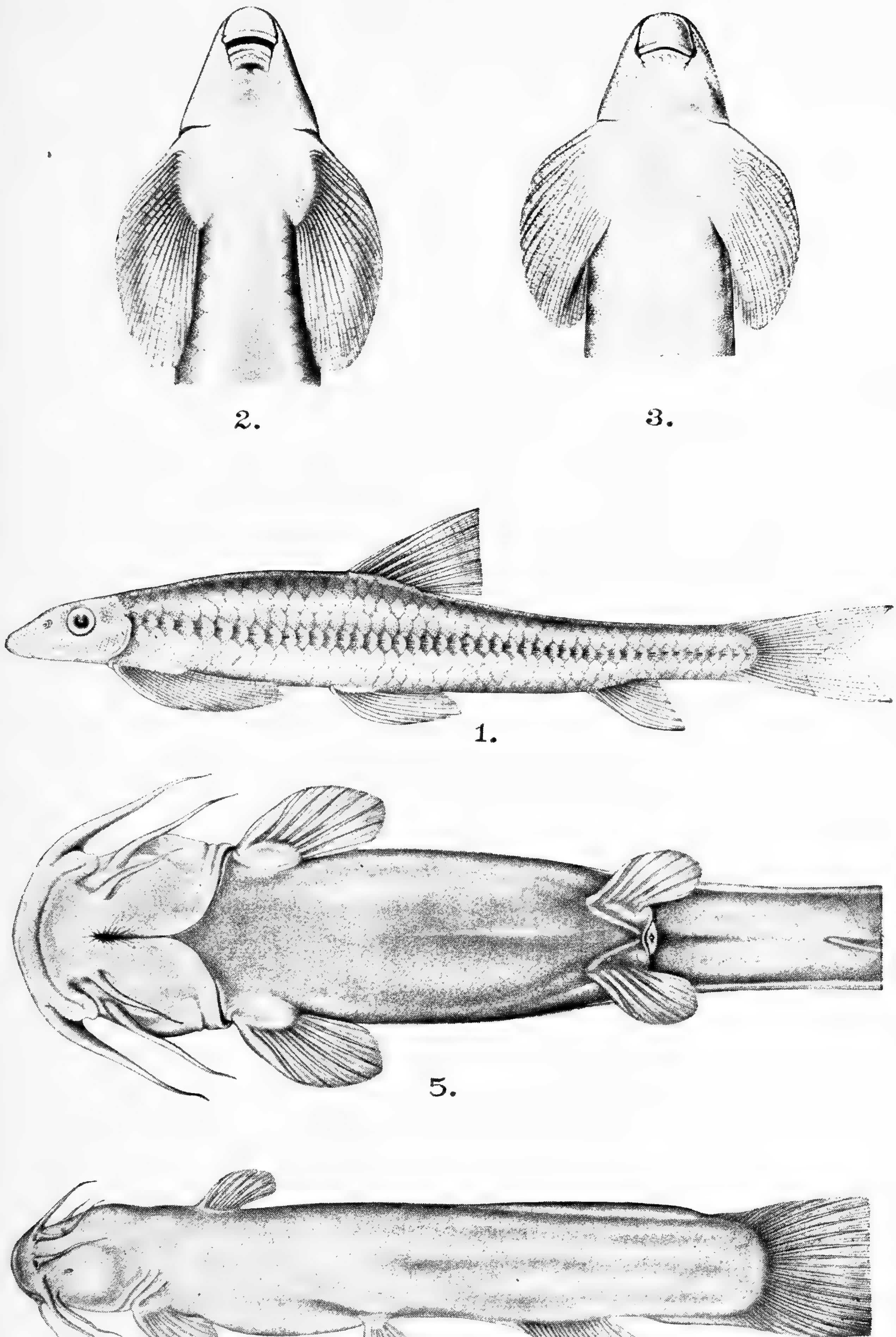
[1] Published with permission of the Director, Zoological Survey of India.



Fishes collected by the Vernay-Hopwood Upper Chindwin Expedition, 1935.

For explanation see end of article.

List of Species.

Specific Name	Locality and number of specimens	Further Distribution
Family FLUTIDÆ		
1. **Fluta alba** (Ziew).	Lonkhin : 5 specimens ...	Manipur, Assam ; Burma; Malay Peninsula and Archipelago, Siam to Northern China; Chinese islands; Formosa and Japan.
Family MASTACEMBELIDÆ		
2. **Mastacembelus unicolor** (K. & V. Hass.).	Mawlaik : 1 specimen ...	Burma to Java.
Family CYPRINIDÆ		
Subfamily *Rasborinæ*		
3. **Danio aequipinnatus** (McClelland).	Kora : 14 specimens ...	India, Burma and Siam.
4. **Rasbora rasbora** (Hamilton).	Dalu : 6 specimens ...	India, Burma and Pihang.
5. **Barilius barna** Hamilton	Upper Burma : 2 specimens ...	India and Burma.
Subfamily *Cyprininæ*		
6. **Barbus (Tor) mosal** (Hamilton).	Lonkhin : 1 specimen ...	India and Burma.
7. **Barbus (Puntius) sewelli** Prashad and Mukerji.	Dalu : 2 specimens ...	Myitkyina District, Upper Burma.
8. **Barbus (Puntius) ticto** Hamilton.	Dalu : 3 specimens ...	India, Burma, Ceylon and Siam.
9. **Labeo devdevi** Hora.	Dalu : 22 specimens ...	Chindwin Drainage, Assam ; Burma and Siam.
10. **Psilorhynchus homaloptera** var. **rowleyi**, nov.	Kora : 3 specimens ...	...
11. **Rohtee cotio** var **cunma** Day.	Kaunghein : 1 specimen.	Chindwin Drainage in Assam, Peninsular India and Burma.
12. **Rohtee feae** (Vinciguerra).	Kalawa : 3 specimens ...	Burma.
Family COBITIDÆ		
13. **Acanthopsis choirorhynchus** (Blkr.).	Kaunghein : 2 specimens.	Sumatra, Java, Borneo, Malay Peninsula, Burma, Siam and Annam.
14. **Lepidocephalus berdmorei** (Blyth).	Dalu : 1 specimen ...	Chindwin Drainage in Assam, and Burma.
Family ARIIDÆ		
15. **Arius jatius** (Hamilton).	Kalewa : 1 specimen ...	Estuaries and rivers of Bengal and Burma.

Specific Name	Locality and number of specimens	Further Distribution
Family SILURIDÆ 16. **Silurus cochinchinensis** Cuv. and Val.	Kaunghein : 1 specimen...	India, Burma, Malay Peninsula and Cochin China.
Family AMBLYCIPITIDÆ 17. **Amblyceps mangois** (Hamilton).	Kora : 2 specimens; Hai Bum : 4 specimens ...	India, Burma, Siam and Malay Peninsula.
Family SISORIDÆ 18. **Exostoma vinciguerre** Regan.	Kora : 1 specimen ...	Upper Burma.
Family OPHICEPHALIDÆ 19. **Ophicephalus gachua** Hamilton.	Kora : 3 specimens ...	Throughout the Oriental Region.
Family NANDIDÆ 20. **Badis badis** (Hamilton).	Burma : 4 specimens ...	India and Burma.
Family AMBASSIDÆ 21. **Ambassis baculis** (Hamilton).	Kaunghein : 2 specimens.	India, Burma and Siam.

Most of the species are widely distributed in parts of the Oriental Region and do not require any further comments. Some of the species, such as *Barbus* (*Tor*) *mosal* (Hamilton)[1], *Barbus* (*Puntius*) *ticto* Hamilton[2], *Barbus* (*Puntius*) *sewelli* Prashad and Mukerji[3] *Labeo devdevi* Hora[4], *Rohtee cotio* var. *cunma* Day[5], *Rohtee feae* (Vinciguerra)[5], *Silurus cochinchinensis* Cuvier &

[1] Hora, S. L.—'The Game Fishes of India. X. The Mahseers or the Large-scaled Barbels of India. 3. The Mosal Mahseer, *Barbus* (*Tor*) *mosal* (Hamilton)'. *Journ. Bombay Nat. Hist. Soc.*, vol. xli, pp. 784-794 (1940). The measurements of the specimen from Lonkhin are given on page 789.

[2] Hora, S. L., Misra, K. S. and Malik, G. M.—'A Study of Variations in *Barbus* (*Puntius*) *ticto* (Hamilton)'. *Rec. Ind. Mus.*, vol. xli, pp. 263-279 (1939). The measurements, scale-counts and position of colour spots of the specimens from Dalu are given on page 274.

[3] Prashad, B. and Mukerji, D. D.—'The Fish of the Indawgyi Lake and the streams of the Myitkyina District (Upper Burma)'. *Rec. Ind. Mus.* vol. xxxi, p. 197, pl. ix, figs. 1, *1a*, *1b* (1939). *B. sewelli* is represented in the collection by juvenile specimens.

[4] Hora, S. L.—'On a Further Collection of Fish from the Naga Hills'. *Rec. Ind. Mus.*, vol. xxxviii, pp. 323, 324 (1936); 'Notes on Fishes in the Indian Museum. xxxii. On a Small Collection of Fish from the Upper Chindwin Drainage'. *ibid.*, vol. xxxix, p. 333 (1937). In the collection under report, *Labeo devdevi* is represented by juvenile specimens.

[5] Hora, S. L. and Misra, K. S.—'Notes on Fishes in the Indian Museum. XL. On Fishes of the genus *Rohtee* Sykes'. *Rec. Ind. Mus.*, vol. xlii, pp. 155-172 (1940). Measurements, number of anal rays, and scale-counts of the Kaunghein specimen of *Rohtee cotio* var. *cunma* are given on page 170, while those of the two specimens of *R. feae* from Kalawa are given on page 158.

Valenciennes[1] and *Exostoma vinciguerra* Regan[2] have already been dealt with in recent years, while notes on *Psilorhynchus homaloptera* var. *rowleyi,* nov. and *Amblyceps mangois* (Hamilton) are given below. The occurrence of *Arius jatius* (Hamilton) in the Upper Chindwin Drainage is of special significance, for though the species is known to ascend far above tidal reach its record from such great distance from the sea is rather unusual. As pointed out by Hamilton[3] the palatine teeth are entirely absent.

Psilorhynchus homaloptera var. **rowleyi,** nov.

Plate I, figs. 1 and 2.

In 1935, Hora and Mukerji[4] described a new species of *Psilorhynchus, P. homaloptera,* from the Brahmaputra Drainage of the Naga Hills, Assam. Next year, Hora[5] recorded two more specimens of the same species from this region. In the collection under report, there are three specimens from Kora which are generally similar to *P. homaloptera* (Plate I, fig. 3), but the body is only slightly depressed, the caudal peduncle is more slender and narrow, the head is somewhat more pointed, the interorbital space is narrower and the eyes are proportionately larger. We believe that these specimens represent a distinct Burmese variety of the species which we have named after Major Rowley, a member of the Expedition.

The differences noted above between the typical form from India and the Burmese variety are of the same nature as pointed out by Hora[6] between *Balitora brucei* Gray from India and its variety *burmanica* Hora from Burma.

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[1] Hora, S. L.—'Siluroid Fishes of India, Burma and Ceylon. VII. Fishes of the genus *Silurus* Linnaeus'. *Rec. Ind. Mus.,* vol. xxxviii, pp. 351-56 (1936).

[2] Hora, S. L.—'Notes on Fishes in the Indian Museum. V. On the composite Genus *Glyptosternum* McClelland' *Rec. Ind. Mus.,* vol. xxv, p. 41, pl. iii, figs. 1-3 (1923).

Now that the generic limits of *Glyptosternum* McClelland have become sufficiently defined, we recognise the divisions into which this composite genus has been divided by Regan, Norman and Smith (*Journ. Siam Soc. Nat. Hist. Suppl.,* ix, p. 71, 1933). The generic appellation *Exostoma* Blyth is, however, inappropriate, for, as shown by Hora (*loc. cit.,* p. 3), its type-species belongs to *Glyptothorax* Blyth. Till fresh specimens of *E. berdmorei* Blyth become available, we do not wish to disturb the present nomenclatorial arrangement and have accordingly adopted the generic name *Exostoma* for *E. labiatus* Blyth and allied forms.

[3] Hamilton, F.—'*An Account of the Fishes found in the River Ganges and its tributary branches,*' pp. 171, 376 (Edinburgh, 1822).

[4] Hora, S. L. and Mukerji, D. D.—'Fish of the Naga Hills, Assam'. *Rec. Ind. Mus.,* vol. xxxvii, pp. 391-397, pl. vii, figs. 1-6 (1935).

[5] Hora, S. L.—'On a Further Collection of Fish from the Naga Hills'. *Rec. Ind. Mus.,* vol. xxxviii, p. 318 (1936).

[6] Hora, S. L.—'Classification, Bionomics and Evolution of Homalopterid Fishes'. *Mem. Ind. Mus.,* vol. xii, p. 291, pl. xi, fig. 6 (1932).

Measurements in millimetres.

Standard length	61·5	75·0
Length of head	12·0	14·0
Height of head	7·0	9·0
Width of head	10·0	11·0
Diameter of eye	4·0	4·5
Length of snout	5·0	6·3
Interorbital distance	4·9	5·6
Depth of body	9·5	12·0
Width of body	9·5	12·0
Length of caudal peduncle ..	10·5	11·0
Least height of caudal peduncle ...	4·5	5·5

Amblyceps mangois (Hamilton).

Plate I, figs. 4 and 5.

1933. *Amblyceps mangois*, Hora, *Rec. Ind. Mus.*, xxxv, pp. 607-621.

The specimens of *Amblyceps mangois* from Hai Bum are the largest yet recorded, the largest specimen being 163 mm. in total length. In these examples the head and the body are covered with a felt-like growth of papillae. The lips are also thickly papillated. The eyes are very minute, almost indistinguishable, and the caudal fin is truncate. The adipose fin is thick and low, and just forms a ridge.

Owing to their strong build, these specimens are liable to be confused with *Liobagrus* Hilgendorf, but can be readily distinguished on account of the respiratory structures associated with the gill-openings (*vide* Hora, *loc. cit.*, p. 612). The larger examples are superficially not dissimilar to *Glyptosternum* McClelland (=*Parexostoma* Regan), but the extent of the gill-openings, and the position and form of the various fins are sufficient to distinguish the two types of fishes.

The pelvic fins are close together on the ventral surface and are provided with muscular bases. Some of the specimens are heavily parasitised by worms which are encysted in the body wall and on the fins.

In recent years the range of distribution of *A. mangois* has been greatly extended. It is found in the Malay Peninsula, Burma, Siam, Assam Hills, Himalayas, Rajmahal Hills, Santal Parganas and the headwaters of the Mahanadi River.

Explanation of Plate

Fig. 1.—Lateral view of the type-specimen of *Psilorhynchus homaloptera* var. *rowleyi*, nov. × $1\frac{2}{3}$.

Fig. 2.—Ventral surface of head and anterior part of body of the same. × $1\frac{2}{3}$.

Fig. 3.—Ventral surface of head and anterior part of body of *Psilorhynchus homaloptera* Hora & Mukerji. × $1\frac{2}{3}$.

Fig. 4.—Dorso-lateral view of a specimen of *Amblyceps mangois* (Hamilton) from Hai Bum. × 5/6.

Fig. 5.—Ventral surface of head and part of body of the same. × *ca* $1\frac{1}{2}$.

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THE MALAYAN ELEPHANT.

(ELEPHAS MAXIMUS INDICUS).

BY

THEODORE HUBBACK.

(*With 8 plates*).

INTRODUCTION.

In the Abstr. Proceedings of the Zoological Society of London (No. 130, 1914, page 20), Richard Lydekker designated the Malayan Elephant as a sub-species of *Elephas maximus,* giving it the name of *Elephas maximus hirsutus.*

On page 285 of the Proceedings of the Zoological Society, 1914, there is an amplification of this dictum.

The sub-species was made on the following grounds :—

> '. . . characterized by the square instead of triangular ear, the early date at which its upper margin is bent over, and the presence in the young condition, at least in some cases, of a thick coat of black and in part bristly hair . . . "

There is, I think, little doubt that the above description does not apply to the normal wild Malayan elephant and it seems that the sub-species was made on insufficient data.

I have seen many young wild Malayan elephants from babies still in the pink stage to those of four or five feet in height, but I have never noticed a thick coat of hair on any of them.

I have handled several baby elephants and I must have noticed had they been covered with thick hair. All Malayan elephants have a certain amount of hair or bristles on parts of their bodies but not in sufficient quantities to differentiate them from other Asiatic sub-species.

Also the description of the shape of the ear does not agree with the shapes of the ears of mature or semi-mature wild elephants that I have seen. The photographs illustrating this article show the usual triangular ear which we associate with *Elephas maximus,* and although it is possible that some abnormality presented itself to Lydekker which led him to believe that a square ear was typical of the Malayan elephant, it is not a normal characteristic in those I have seen. It is true that in the Malayan elephant the upper margin of the ear is bent over at an early age. I have a photograph of a young wild elephant, not more than six feet high, showing the fold on the upper margin of the ear.

In a recent publication entitled *Handlist of Malayasian Mammals,* compiled by Mr. F. N. Chasen, Director of the Raffles Museum, Singapore, Straits Settlements, he disagrees with the deductions of Lydekker and suggests *Elephas maximus indicus* as the nomenclature for the Malayan sub-species.

I think that Lydekker's premises were wrong. I agree with Mr. Chasen that as a sub-species has been created for the Malayan elephant it should be called *indicus* and not *hirsutus*. Chasen himself writes—

'It has not yet been demonstrated that the elephants of Siam and the Malay Peninsula differ from the Indian form . . .'

It seems therefore that *indicus* is the more suitable name if *hirsutus* can be shown to be inappropriate. In remote ages wild elephants came down the Malay Peninsula from the north, and until it is shown that the elephants in Malaya have some more or less general characteristics which distinguish them from the Indian variety I think we should be content to call them *Elephas maximus indicus*.

I cannot agree to the claim put forward that the Malayan elephant is of a smaller size than the Indian elephant. I have known of several elephants which have been shot in Malaya which measured over 9′ 6″ at the shoulder. I shot one myself measuring 9′ 6½″, and Mr. E. Frederiksen shot one measuring 9′ 8½″. Although elephants in India have been recorded as having measured over ten feet such occurrences have been rare and may well be considered abnormal. Blanford in *Fauna of British India* states that the height of adult males does not as a rule exceed 9′ 0″ at the shoulder and I should say that this is correct for the Malayan form.

In Malaya tusks weighing over 70 pounds the pair are not uncommon and, as I have shown later on, tusks up to over 140 pounds the pair have been obtained. Such a weight however should be considered very exceptional.

During the last few decades the numbers of firearms has increased so much in Malaya that many elephants have been shot under the mistaken idea that allowing such indiscriminating slaughter benefits the cultivator by saving his crops; a fallacy which is very apparent to anyone who has lived in Malaya for many years. Many elephants are wounded and injured by this method and I think it is fair to say that few male elephants in Malaya reach a ripe old age. This might account for the comparatively small ivory that is generally obtained in Malaya.

Before passing on to the main theme of this article I should like to mention the fact that the origin of the wild elephants in Borneo is somewhat obscure. They are found only in the northern portion of the island; in that part of the territory known as British North Borneo.

I am informed that the earliest mention made of elephants in Borneo is by Pigafetti, Chronicler of Magellan, who records that during a visit to Brunei in 1521 they were conveyed to the palace on caparisoned elephants. But this does not prove that they were indigenous to Borneo.

There is a persistent story that a Prince from the West presented the Rajah of Solo with some tame elephants, but the Raja found that these elephants were rather a nuisance so he had them shipped to the east coast of Borneo and there let loose.

If this is true it may account for the wild elephants in North Borneo, but we are still left without knowledge of their exact origin.

The only clue, and a very slender one, is the fact that many, possibly most, of the mature male elephants in Borneo have very straight tusks and do not conform with the usual curved tusks of *Elephas maximus.*

It is possible that the Borneo elephants came originally from Sumatra. Dutch records will show whether straight tusks are common or not amongst the wild herds in Sumatra. I have seen photographs of elephants shot in Sumatra and their tusks appeared to be straighter than those I have generally seen in Malaya.

Distribution of the Malayan Elephant.

Wild elephants, not so many decades ago, were widely distributed throughout Peninsular Malaya, but owing to the opening up of the country for commercial purposes there is now probably not a tenth of the number of elephants that once roamed the Malayan jungle.

The elephant has not been wisely conserved; it has been looked upon as a menace to progress and quite unnecessary loopholes have been permitted in the Game Laws to enable *Elephas maximus* to be destroyed on the weakest grounds. This is not the place to go into the harm which has resulted from the wounding of many elephants by irresponsible persons, who are allowed to shoot at an elephant in alleged defence of crops with any weapon, however inadequate: but such actions have resulted in large numbers of elephants being wounded and becoming rogues, thus establishing a vicious circle difficult to deal with.

At the present time on the West Coast of Malaya there are few elephants left, and those left are by no means left in peace. In many places untidy native cultivation is an attraction to elephants, and as many of these clearings are allowed to take care of themselves for weeks at a time much damage is sometimes done to what is called 'cultivation'. There is then a clamour for more executions, so the Malayan elephant's hopes for the future are very uncertain. Perhaps due to the persecution that they have been subject to, elephants in the higher country in Malaya have taken to travelling long distances right up to the tops of the mountains. I have seen the tracks of elephants as high as 5,000 feet altitude, but they have been seen even on the tops of the highest mountains which reach to 7,000 feet. Generally these wanderers are solitary bulls, but not necessarily old animals, and disturbance may have something to do with their long treks. I have seen herd elephants between the 2,000 feet and 3,000 feet contour, but they were feeding on bamboo at the time, which was no doubt the attraction, and their presence may be considered as a normal migration during the bamboo season.

The elephant is not used to any extent in Malaya for transport and very little for show. There are no tribes here, as in India, who have made a living for generations by tending elephants, and there is not the same desire to conserve the elephant for purposes of utility.

In Burma and Siam they are extensively used in the teak forests, but here there is nothing to correspond to that class of labour.

There are no reserves on the West Coast which are of any use to elephants, except possibly a sanctuary in Johore near Segamat. With that one exception I think we must recognize that the Malayan elephant on the west side of the Peninsula is doomed to extinction, although for many years an occasional animal or two may be found in the mountainous country.

On the East Coast, the position is better because the country is less opened up and there are at least two reserves which should prove the saving of the Malayan elephant as a species. The King George V National Park, an area of nearly 1,800 square miles, extending over portions of the three States of Pahang, Trengganu and Kelantan, is mostly mountainous terrain, but still is favourable in many parts for elephant.

The danger lies in the defective and inadequate legislation which has been passed to guard this sanctuary. Unless great care is taken, the Park will become a refuge for wildlife, including elephants, in name only.

I do not think that wild elephants have been recorded as having been found on Singapore Island, but they have reached the southernmost portion of the Peninsula and have roamed the jungles from coast to coast. The whole of the Malay Peninsula was their domain in days not so far past, and there is still sufficient of their natural environment left to make it possible, with wise conservation, to save them from extermination.

The Malayan Elephant and His Jungle.

Malayan elephants spend most of their time in primeval forest and it is, I think, only after their true habitat has become too restricted for their needs that they have to forage for food in secondary jungle, and so tend to become a nuisance to cultivators and contract the habit of going on to cultivated or semi-cultivated land.

The Forest Reserves in the low country of Malaya are no permanent refuges for elephant because they are at times much disturbed, and elephants like all other wild animals hate disturbance.

The Malayan elephant is compelled to travel great distances in search of food. It is a discriminative eater and does not take just whatever comes to hand. G. P. Sanderson in his well-known book *Thirteen Years Among the Wild Beasts of India* writes:

> 'An elephant in captivity should be supplied with 800 pounds of good fodder every day, of which it will eat about 650 pounds and waste about 150 pounds.'

It is unlikely that a wild elephant eats less than an elephant in captivity, so it does not require any great stretch of the

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imagination to appreciate that a mature wild elephant has to do a good deal of foraging to satisfy its appetite. Anyone, who has tracked wild elephants in virgin jungle, knows that they cover many miles through the forest during the day, picking up a little food here and there, but doing most of their feeding during the night.

Although a herd of elephants probably has more or less defined parts of the country in which it feeds, and although this terrain covers a big area, when elephants have been much disturbed and their domain restricted by the opening up of the country, then damage to cultivation is likely to occur.

For many years in the Plus Valley in Perak, a district well patronized by rubber planters, considerable damage was done to para rubber cultivation. When giving evidence before the Wild Life Commission of Malaya in 1930, European witnesses stated that during twenty years of endeavour to deal with the elephants that raided their estates in that area, 36 elephants had been shot; the value of rubber trees destroyed by elephants was estimated at £20,000; and there were more elephants than ever.

However a scheme was inaugurated on the recommendation of the Commission that overcame the difficulties, which as records show was a complete success. The useless killing of elephants ceased. By a system of patrols, the cost of which was met half by the government and half by the estates, elephants were prevented from reaching the planted area. The result of this action shows that indiscriminate shooting of elephants, as in this case, was not only unnecessary but useless as a complete defence to the menace from marauding elephants. The Plus Valley scheme can well be considered as an example to others who wish to protect cultivation and at the same time preserve wildlife.

Since those days the electric fence has come into use and I have no doubt will prove, where properly erected and looked after, a very efficient check against wandering elephants.

Where land is given out in isolated blocks in elephant country for, what will most certainly result, in 'fugitive cultivation', where the main game trails are cut up, and where temporary crops are planted in, what might be described as favourite stamping grounds for the larger fauna, there is bound to be trouble from elephants.

Under such conditions they will sometimes be driven away, sometimes wounded, sometimes even killed, so, in such country, they move on and on in search of that solitude and tranquillity which must be part of their normal life. Thus they get forced back and back into unopened mountainous country which is not a congenial environment, nor can it be a permanent part of their true habitat, and is not, I believe, suitable country for normal breeding.

When with a herd, a newly born elephant is a fascinating little animal; fussing around amongst the legs of its mother; waving about a much undeveloped trunk; very important; and with its pinkish skin making a striking note in the picture. This pinkish colour is probably retained for some weeks, but it is difficult to

make accurate observations on colour because the wild elephant is so often covered with mud.

I recollect on one occasion, when hunting elephants, trying to locate a tusker which I knew was with the herd. While doing this some of the herd moved uphill away from me and ran across the trail we had made a few minutes before when making our approach. Immediately a shrill trumpet gave the alarm and an avalanche of elephants came down the hill towards our position. I slipped behind a tree, a big comfortable tree, expecting the elephants to sweep past me. None of them came unpleasantly close; but an old cow, another female and a tiny calf seemed to deliberately change their direction and stopped a few yards on the other side of my tree. I had a good view of the calf. Its little trunk, still much undeveloped, waved about aimlessly from under its mother. There was no mistaking that the calf had flesh-coloured skin which certainly had no long hair on it. Presently these elephants moved off down the hill to join the rest of the herd; not altogether to my disappointment! I never caught up to the herd again and so did not see the tusker.

I do not know how long the calves suckle their mothers. Plate No. 1 shows a young calf with its mother and clearly shows the female's left breast full of milk. This calf was not very small but I could not estimate its age.

So soon as the calves get a little bigger they become independent, and although they do not wander far from their mother or from the other female, which is generally in attendance, and about which I have something to say later on, they act exactly like children and frequently become a nuisance to their elders. It is no uncommon thing, when in the vicinity of a herd of elephants, to hear a shrill squeal from a baby elephant, which is in protest to some correction by its mother generally a whack from her trunk. As Plate No. 1 shows a small elephant, even when suckling, will take its place at a salt lick amongst the big elephants, and try to get its share of the sulphur water with the best of them.

In that particular case I think the baby was not very successful because it wandered away from the lick after a minute or so and seemed uncertain what to do with itself. The playfulness of elephants even when mature is well shown in Plates Nos. 3 and 4 where a young tusker climbs up on to a log just for fun. Plate No. 4 shows by the expression on his face how pleased he was with himself, and well he might be, because he balanced himself on a log split down the middle and not more that twelve inches wide in the broadest part. Having done that he proceeded to walk along the log, turned round, retraced his steps, got down from the log more or less where he had got up, and then as Plate No. 5 shows disappeared out of the picture. The elephant shown in the illustration was one of a herd of seven, three of which were tuskers, but all young ones. There was a calf in the herd about four feet high. The log which attracted the attention of the young tusker has been used many times by elephants doing the same trick. It is a live log and the abrasions on the bark

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YOUNG TUSKER MOUNTS A LOG.

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SOMETHING DONE.

Copyright] "GOOD NIGHT." [*T. Hubback*

caused by the elephants' feet or toe nails grow into little knobs with which the top of the log is covered. These knobs are shiny and polished by the action of numerous elephants amusing themselves on the log.

This herd of elephants was in the same lick as the one shown in Plate No. 1, and had a great time. But not until the leading cow accompanied by a young tusker, probably her son, had had their fill, would any of the others go near the lick.

I have seen this happen more than once. Twice have I seen two tuskers come into the lick when the bigger one would have his fill first, the smaller one patiently waiting his turn. In one case the smaller one got fed up and after circling around for some time left the lick without getting his medicine at all.

I am sure elephants show great respect for their elders and the younger ones would never think of disputing their rights to the first place in a lick. I have seen the same thing happen with seladang (*Bibos gaurus*), and I think we might well take a lesson in these matters from wild animals whose behaviour under normal conditions is exemplary.

One very striking habit of wild elephants, which I have often seen, is that when an elephant is very small another female elephant will attach itself to the mother appearing to act as a 'nurse' or protector. Those Malays, who are well-versed in jungle lore, recognize this phenomenon and call the second elephant the *pengasoh,* meaning 'nurse' or 'foster-mother'. The incident I have related of the little pink calf coming so close to me was enhanced in interest by the presence of a second cow. I have often seen two cows and one calf and I believe that it is by design and not just accident. Malay jungle gossip says that the *pengasoh* is the one to watch if approaching a herd wherein there is a small calf. The nurse, they state, will take the offensive while the mother bustles away with the calf. I have never seen this happen. Malays cannot be considered reliable witnesses, because they generally mistake quick movements of wild animals as presaging an attack, and do not wait to observe what really happens.

Cow elephants always, I believe, remain all their lives with their herd or with one or two companions. They are generally separated from the herd when calving but not always. I remember an extraordinary incident that happened on a rubber plantation in Negri Sembilan many years ago. An elephant had a calf sometime during the night on the estate amongst the rubber trees. She was with a herd, and after having heard tremendous trumpetings during the night, some of the labourers went to investigate the next morning. They found no elephants but discovered an enormous after-birth, which alarmed them so much that they reported to the manager they had found the remains of some extraordinary thing amongst the rubber, which they believed had been left there by the elephants! The manager had it well and truly buried. That is the story I had from the manager whom I knew well. He told me that the elephants had left the estate immediately and were not in the vicinity for some time. It appears that, in this case

anyway, the baby elephant was able to get away or be moved away a few hours after it was born.

In the dense jungle of Malaya it is not easy to observe the habits of wild animals even elephants, and one's knowledge of their lives is bound to be meagre. When hunting them one has plenty of opportunity of learning how they react when frightened and occasionally, if you hunt enough, when they are angry; but except to know what they are likely to do under certain circumstances, for instance after heavy feeding or when anxious to catch up a herd, one really learns very little about the elephant that lives in a forest.

But, if one takes to the art of photography and tries to get pictures of elephants one then has a chance of learning something about them when undisturbed, when unafraid, and when going about their ordinary occasions. I hunted elephants over a period of thirty-five years, until about five years ago, when age precluded me from further strenuous hunting. So I took up wildlife photography in the Malayan jungle and during the last five years I have learnt more about the normal behaviour of elephants and other large game than I learnt in all the previous years.

However, before I go on to tell you about the observations I have made of elephants going about their daily rounds and of their visits to salt licks, I should like to give you a few instances of what I gleaned when I was still a hunter.

I often noticed, when following solitary elephants, that, when they fed extensively on a certain creeper known to Malays as *akar beluru* and to Science as *Entada schefferi,* they invariably travelled far after such a meal. Possibly that particular creeper has some sustaining effect on the elephant which acts as an incentive to greater and unusual effort; and although this may seem a rather far-fetched theory, I have noticed this stimulating effect on an elephant's activities too often to be mistaken about it. On the other hand, when elephants have been feeding on a palm called *bayas* in Malay and *Oncosperma horrida* in the text books, they are lethargic and unwilling to travel very far. In fact I have known occasions when an elephant, having fed well but possibly not too wisely on this palm, would not travel more than a few hundred yards from where there was a stand of this plant before he would lie down for a nap; only to return again on waking up to have another gorge. Possibly the cabbage of this palm may contain something which acts as a soporific on the elephant? The cabbage is excellent eating for human beings.

The elephant's method for getting at the pith of the palm is interesting. *Bayas* is covered with an extremely tough, long and nasty thorn which points downwards, so the elephant presses his forehead against the palm which, if not too old, is pushed over. He avoids getting the thorns into his forehead because he presses with the grain so to speak. Having got his tree down he proceeds to stamp along the upper half of the trunk from the leaves at the top, and when it is well and truly reduced to a pulp he eats as much of the pith as he thinks he can digest. He eats all the cabbage! This takes a long time because the *bayas* palm is never

very big, probably never more than two feet round, and not much pith can be picked out at one time. I have often thought when looking at a *bayas* that had been pushed over, stamped almost flat with all the pith removed, how extraordinarily patient and persistent the animal must have been to pick out the centre of the tree and leave everything else.

I have never known elephants eat the leaves or roots of wild ginger. Malays call these plants *tepus* or *pua*. There are so many varieties of wild ginger in Malaya that it is quite possible elephants may eat some of those I have never come across. I have often seen where they have stamped about and even pulled up some wild ginger roots but I could never find signs of any of it having been eaten.

Elephants are fond of many palms and will feed extensively off the roots and shoots of *bertam* (*Eugeissona triste*). This palm is considered by Forest Officials to be a pest because it grows very rapidly and extensively, preventing the regeneration of the useful forest. *Bertam* is a valuable thatch for houses and as such the leaves are much used by the peasants. It is only found in primeval forest not in secondary jungle. I have noticed where elephants were once fairly numerous and where now they are not to be found that the *bertam* had increased very much and I could only suppose that so long as there were elephants in that part of the jungle they kept the *bertam* in check? That at least can go to their credit account.

Elephants are fond of most of the varieties of bamboo of which some large varieties, such as *Dendrocalmus flagellifer,* are common in Malaya in the higher country. When bamboos throw out fresh shoots elephants are particularly attracted to the vicinity, but they are liable to feed on bamboos at any time.

Bamboos in the Malayan jungle produce shoots almost every month in the year, and although in the hill country there is no real bamboo jungle, that is to say no great extent of bamboo except where it is a secondary growth on old Sakai (aborigines) clearings, there is no shortage of bamboo for elephants throughout most of the undeveloped country.

I have mentioned how mischievous young elephants can be, and when a herd raids cultivation or solitary elephants visit houses or shacks they often behave in a peculiar way and eat things which normally would not come within the scope of their diet.

I call to mind a case of a young solitary elephant which had taken a fancy to visit certain dilapidated huts around which there was a neglected grove of bananas. The people who lived near by, Sumatra Malays, left their houses to take care of themselves and the elephant no doubt emboldened by the lack of human occupation went farther afield than the shacks and started to investigate the inside of a house recently abandoned. He pulled down the rear side of the house and feeling about with his trunk found a sack of padi (unhusked rice) which he scattered all over the place. He also upset other things in the house and pulled down a lot of clothes which were hanging on a line outside.

I visited the place the following day and could see that the elephant had thoroughly enjoyed himself!

I followed the elephant, and after tracking him for about three miles, found where he had stopped to feed and rest. Presently still following his tracks I saw an enormous heap of droppings out of which protruded a piece of cloth. I thought this rather unusual so investigated. We discovered a complete and uninjured Malay sarong—the cotton skirt worn by Malays. This had probably come off the clothes line. I told one of my men to take it to a stream which was close by and wash it. This he did. We then proceeded after the elephant. Two days afterwards I returned to the road, hunted up the owner of the house which had been raided by the elephant and asked him if the sarong was his. He said it belonged to his daughter. I explained to him that such a sarong would now have magical properties because it had been carried through the jungle inside an elephant and had been recovered. Why I told him this was because Malays attach great value to an entire *durian* fruit that is supposed to have passed through an elephant and been deposited in its droppings.

The *durian* (*Durio zibethinus*) is the fruit most valued by Malays one reason being that it is credited with being an aphrodisiac. The potency of the fruit is greatly enhanced if it has been eaten or swallowed by an elephant but not digested!

An elephant is reputed to wrap the *durian*, which is covered with formidable spikes, in some leaves and swallow it whole. I need scarcely say that I have never seen anything of the sort. But elephants are fond of *durians* and will stamp on a fruit which has fallen from the tree and pick out the pulp covered seeds from the flattened mess of spikes. I have often seen where that has been done. It is inconceivable that an elephant can swallow a *durian* whole, but I relate the fable as illustrating the credulity of Malays. So perhaps the Malay got my meaning about the sarong!

I remember an incident where some Chinese arrived at a remote spot near a newly constructed road where they wanted to undertake some mineral prospecting work. They had already had a community house erected by Malays and they turned up one afternoon with two bullock carts—it was in pre-motor days—loaded with provisions, mostly rice, which they proceeded to store in the new house.

That night a small herd of elephants turned up and investigating this alteration to the landscape proceeded to pull the walls of the house down. The walls were only palm leaves. The Chinese had heard the elephants before they reached the house, and instead of blowing up their fires and beating some of the kerosene oil tins that they had with them and generally making their presence known, which would have scared the elephants, they climbed up into the rafters of the roof! Quite the worst place they could have gone to, especially with the elephants playing about below them and quite capable in their elephantine way of pushing the house over. The elephants played about with the provisions and scattered the rice everywhere. I happened to be on the spot a

day or two afterwards—the elephants had banned the prospecting and the Chinese had gone—and found rice scattered all over the road in front of the house. I examined the tracks of these elephants and followed the trail they had made when they left the vicinity. I noticed that rice was distributed along the trail and wondered how it had got there. I followed this rice trail for a mile and then came across the remains of a sack which had contained the rice and which an elephant had obviously brought to the spot from the house. It was not much torn and I can only suppose that it had got attached to an elephant's tusk and that he was unable to shake it off. His tracks did not show signs of panic so I suppose he did not object to the sack very much. He may have carried it with his trunk. Wild elephants often carry about in their trunks bunches of palm leaves with which to beat off flies and possibly this elephant thought the sack might serve such a purpose!

I was once after an elephant which had been causing some trouble, and had killed one or two people and created a reign of terror in the district he frequented.

We had a long trek after him. He took us up to the top of a hill, which at sometime or other had been cleared by Sakai, and was now covered with an oldish secondary growth of jungle. We knew we were close to the elephant: we could smell him. Presently, when peering about through the heavy undergrowth—his tracks criss-crossed all over the hill top showing that he had been there for some time—I saw what looked like a mound of earth but of a peculiar colour. Going a little closer I saw something waving about in the air and realized that what I had mistaken for a mound of earth was the stomach of the recumbent elephant and that what was waving about was a bunch of palm leaves held in his trunk. The leaves were being used as a fly switch.

I could then make out a little more of the elephant but the ground was unfavourable and there was a large ant-hill between myself and the beast which masked my view. An approach from another direction was ruled out on account of wind. I was close to the elephant, twenty yards at the outside, and I felt sure that when he stood up, as he was bound to do presently, I must bag him. Presently the fly switch stopped waving about and I saw the elephant very slowly bending one of his hind legs. I could not see his forelegs. I realized that he had our wind and was about to jump up. Perhaps an elephant cannot jump but his extraordinarily quick movements can only be described by that word. He bent his hind leg inch by inch until he had bent it pretty well as far as it would go, and then was on his feet and had swung round away from me so quickly that I had no chance of getting a bead either on his head or behind his shoulder. He was gone. I followed him for some time and came up to him in thick jungle, when he heard me, turned round towards me, and then swung away down a steepish hill side. He was gone again. The very rapid movements of this elephant on both occasions were really astonishing and I had no sort of a chance of killing

him. Perhaps he had a guilty conscience? I did get him the next day however. I slept on his tracks and followed him up into the foothills of the main range.

I have often seen letters in sporting papers discussing the habits of elephants and in some cases disputing the fact that elephants lie down to rest or sleep except very occasionally. I do not pretend to any first-hand knowledge of the African elephant but the Malayan elephant most certainly does lie down when he wants to rest. It is one of their regular habits to lie down during the heat of the day and I have often seen them or disturbed them when sleeping. One of the chances of getting a clue to the size of a bull's tusks is to examine a place where he has been lying down to find the impression of a tusk. They favour sloping ground, the side of a low ant-hill being a common selection for the mid-day nap.

That they also doze, I would not say sleep, leaning against a tree is true but this is no substitute for their regular sleep. In following a herd I have almost invariably found the spot where they have been sleeping during the daytime—sometimes lying almost in a heap! They often lie down in the vicinity of a favourite salt-lick especially if there is a youngster with the herd.

Elephants like tapioca (*Manihot utilissima*) which is grown in some quantities throughout the Peninsula. Sakai especially favour its planting it being an easy crop to look after as it wants no attention! Elephants pull up the shrubs and eat the tubers. Complaints are sometimes made that elephants are doing damage to tapioca plantations, which generally belong to Chinese; but there is usually some contributory cause.

I recollect one case where much damage was alleged to have been done to a Chinese-owned tapioca plantation. This place was inter-planted with rubber which was more valuable than the tapioca, and both products were suffering. There were two elephants accused of this marauding but when I visited the estate only one was in residence. I shot this elephant which practically lived on the plantation. The reason was not far to seek. The unfortunate animal had been wounded by a piece of a mild steel rod two inches long, sharpened at one end, which had been fired from a twelve bore gun. This 'bullet' was embedded in the muscles of the left hind foot, the elephant having been shot from behind. He had not only a badly swollen foot but was unable to walk except quite slowly. The other elephant was shot not long afterwards by a friend of mine who found that it had a terrible drop-spear wound in its back and was no doubt badly incapacitated. These two unfortunate elephants, unable to go their usual jungle rounds, found easily obtained food on this plantation and so practically lived there. They resented being driven away. Who can blame them? Try taking a bone away from a well-fed dog and see what he thinks about it? These poor wounded animals were unable owing to the action of man to go about their lawful occasions and had to get food as best they could.

I traced the steel rod to a Malay on the plantation who was employed by the Chinese manager as a 'hunter'—poacher would be a more correct term—and it was due to his action that one of the elephants lived on the estate. The fact that the elephant had been fired at was never disclosed to me at the time I went to the plantation to look for it.

This is a playful habit Malays have after having fired at an elephant; complain of damage to crops but never disclose the fact that the elephant has been wounded.

On one occasion I might easily have got into trouble. I was asked to deal with an elephant which was alleged to have caused a lot of trouble in a small Malay settlement.

I was very busy at the time and could only spare a day. So I left my house in the early morning, while it was still dark, and motoring about twenty miles arrived at the place where a track went into the jungle, taking me to the usual conglomeration of tumble down Malay huts and poor cultivation. An elephant had certainly been in amongst the bananas and weeds and I found that he had visited this place during the previous night, so I had a good chance of getting up to him. I had to get back home that evening and my tactics in dealing with the elephant had to be based on that fact.

I made careful inquiries, and I think I must have been suspicious, because I asked if the elephant had been fired at and was assured that it had not. The truth was that it had been fired at several times and only two days before had been followed up and once more wounded. These wounds merely annoyed it because it came back almost at once to have a few more of the banana plants.

When following it up I was, of course, unaware that it had been recently wounded, but was again I think suspicious when I found that it had travelled for miles and miles from this 'cultivation', and it was not until about mid-day that we came close to it. In those days I had a Malay tracker named Mat Yasin who had been with me for some years and who understood the habits of both elephants and myself. The elephant had followed the bed of a river for a long distance and had then turned up a steep hill which he steadily climbed. We were not far behind him but he was travelling as quickly as we were. Presently he stopped, and I said to Yasin that so soon as he started to feed we must come up to him. Sure enough in a few minutes we heard him feeding on *bertam* palms on a steep hill side along which his tracks had taken us. I could see him but only got a stern view. He was feeding and slowly moving along the hill side. The wind was wrong for an approach from above him; from down hill, I could see nothing. While manoeuvring for an approach—we were within twenty-five yards of him—I saw his trunk go up and wave about in the air. I knew he had scented us and turning to Yasin made a gesture of disappointment because I presumed that he would make off and it was too late to follow him farther because I had to get back.

While my head was turned towards Yasin I was startled to hear a shrill scream from the elephant who swung round and came

straight for us. He bobbed along through the thick *bertam* following his own trail where the palms were broken down and tangled up. I was so taken by surprise that I threw up my rifle without releasing the safety catch, took it down from my shoulder to see what was the matter, then pushed up the catch. The elephant was within ten yards of me when I fired. I almost missed him merely hitting him on the side of the face. Fortunately, that was not to his liking. He threw out both of his forefeet and slid along towards me doing his best to put the break on and pull up. I also was anxious to prevent him running into me so jumped down the hill side. As I turned, when clear of the track, I saw his stern disappearing up the hill. But he did not go far. I heard him stop, and no doubt he intended to fight, having got over the shock of the pain on the side of his face and the flash of the powder just in front of him. I reloaded, scrambled up the bank and almost at once saw him standing sideways on somewhat above me and about twenty yards away. I gave him both barrels behind the shoulder which finished the hunt. But it was quite close enough to be exciting.

Later on I measured where he had stopped and turned up the hill and found that he had slid along about five yards and actually came within six yards of where I had been standing. There were great furrows where he had tried to dig his toes in to stop himself.

This elephant was another victim of the indiscriminate shooting of Malays. He had only one tusk, the other had been broken off owing to a wound in the base of the tusk sheath; a nasty mess of suppuration and diseased tusk being in the socket.

His good tusk had been hit quite recently by a bullet and chipped near the gum. He had several fresh body wounds, mostly flesh wounds. What these unfortunate animals must suffer from these ill attempts to kill them is beyond estimation. No wonder they become rogues. The marvel is that one does not hear of more people being killed.

This is merely one instance amongst many that have been experienced by hunters who have gone after elephants wounded by Malays. A friend of mine was very nearly killed under similar circumstances.

I have in my house a collection of skulls of mature bull elephants and nearly all show signs of old bullet wounds. It is by no means uncommon to hear of elephants being killed with only one tusk, the other damaged or broken off short due to suffering from old wounds.

Elephants when unwounded are not difficult to drive away from cultivation; but when wounded become a very different proposition. The entire question of damage to crops by elephants is intimately connected with the large distribution of guns to Malays and the encouragement given to them to fire at elephants if in the vicinity of 'cultivation'. Elephants undoubtedly become a nuisance and a danger under such circumstances, but the ball is started rolling by irresponsible persons who will cheerfully fire at elephants and then leave them to their fate. Very few Malays would think of following up a wounded elephant, and when firing

at one will generally aim anywhere. Although there is a legal obligation on the person who wounds an elephant to report the fact, in actual practice they seldom if ever do so, with results similar to what I have related.

On one occasion I had a few uncomfortable moments when an elephant which I had fired at for the temple shot, but had failed to kill, came back on his tracks—running away, not charging—and got far too close to me to be comfortable. As he came back on his own track I fired at him again and then with an empty rifle nipped behind a big tree. He came as far as the tree, where I had been standing for some time, and stopped. At this exact spot he got my wind for the first time. Here was I with an empty rifle crouching behind this tree, with the elephant on the other side of the tree swishing his trunk about in the dead leaves trying to locate where the nasty smell came from. Fortunately his trunk did not come round the tree. He presently moved away and shortly collapsed. My second bullet had taken him through the trunk, down his throat, and finished up in his liver.

When one has hunted elephants as long as I have, especially in the dense jungles of Malaya, adventures are bound to come along at times. The man who always kills an elephant with one shot is not a hunter but a liar. It is the adventures that are the real attraction of the chase, besides one can always fight one's battles over again. As Sir Richard told Una in Kipling's story of 'Old Men at Pevensey'—'We talked together of times past. That is all men can do when they grow old, little maid'.

Just one more hunting incident. I was hunting in the mountains and came across the tracks of a sizeable elephant which I followed. He was an old beast with rounded front toe nails, but shortened by much hill climbing. An old elephant in the low country will have long toe nails because the older he gets the more he puts his weight on his heels.

It took me six days to get this elephant. He crossed the main range of the Peninsula three times. Twice he got our wind. That appears to have given him a fright and he travelled a long way. On one occasion we were climbing up a rocky gully which by some conjuring trick the elephant had scrambled up, feeding on wild bananas on the way. He was someway up the mountain and we were not very close to him, but the wind blowing up the gully must have given him a concentrated dose of human scent, well accentuated by our exertions. When we arrived at the head of the gully we found that he had rushed off, followed a ridge for a short distance and then hurled himself down a hill side almost as steep as the gully we had just come up. In his blind rush he went straight through a grove of the deadly *buloh semilian*, (*Dendrocalamus giganteus*), a bamboo which fractures with an edge as sharp as a razor, and normally avoided by elephants except when throwing out new shoots. He got a very nasty cut on his trunk for his panic, and bled freely. The wound, about three inches long, was still wide and gaping when I bagged him a day or two afterwards.

On the last day but one he left the mountains and following one of his old trails came to a place where we had, two or three days before, stored some rice to be picked up if we required it on the homeward journey. We had also stopped there to cook some food. He came to the tree where the rice was kept but was more interested in the ashes of our fire than the rice which he did not touch. Had he destroyed the rice we could not have followed him for the full six days because my carriers would have been out of food; he missed his chance and lost his life. After rummaging about amongst the ashes of our fire he turned off the track and went straight up the mountain again. When we did get up to him he was right on the watershed of the main range in rough country, where manoeuvring was out of the question; one could not follow his trail until close to him. About mid-day on the sixth day, we were climbing up the mountain side following an old elephant path which wound about trying to avoid the steepest places, when we heard him far above us. The only thing to do was to carry on along his tracks, but the broken nature of the ground with many wind eddies following the gorges gave him a good chance of getting our wind before we could get near him.

But our luck was good and gradually after some stiff climbing we were close to him. His trail followed a steep hill side round the head of a gully and following this we saw his enormous hind quarters across the gully. His head was hidden and any approach seemed impossible. He was right on the end of a little spur.

For once, when hunting, the wind did me a good turn. He got our scent; he could not go over the spur so slowly turned round no doubt intending to return by the trail we were on. As he turned he stopped for a brief second and gave me a perfect shot which I was not slow to avail myself of. He slowly sank to his knees and settled down into a sitting posture. He had a good pair of tusks weighing 75 pounds the pair. It was a long trek back to my main camp but nothing mattered now that the elephant was bagged and it had been a hunt never to be forgotten. That sixth day must have been the last day I could have followed him; our provisions were too low to allow me to go farther from my base. I may consider that I had great luck in bagging him at all, and he had had bad luck in not finding my caché of rice.

At times during periods of sexual desire elephants must come to trials of strength; but in all my years following elephants in the jungle I have never come across elephants fighting nor have I seen places where such fights have taken place.

The nearest I ever came to it was on an occasion when I was following a herd of elephants and became aware that overlaying the tracks of the herd was that of a fair-sized bull. There was a bull in the herd I knew, and it looked to me as if this second bull had either been told to keep his distance or was anxious to force his way into the herd. As we came nearer to the elephants we heard trumpet after trumpet and I hoped to have the thrill of seeing an elephant fight. But I think the trumpeting was solely from the following bull screaming in impotent frustration. He

hadn't the guts to force an issue perhaps? But he felt he had to take it out of something and presently he had his revenge on a tree!

He rushed at a soft wood tree of about 12″ in diameter and by a mighty thrust split it in two. He drove so hard that he cut his gum on the fracture of the tree leaving a large blood smear where his tusk had entered. Well, I hope he felt better after that; we all know the benefit that accrues from letting off a little steam at times.

But elephants use their tusks in more useful ways than as safety valves. I remember seeing a coconut tree which had been pierced by an elephant's tusk and actually uprooted. This was done, I think, by accident, because the elephant having driven his tusk into the tree could not get it out again and in his struggles pulled the tree up. I felt sure that was what happened because he carried the coconut tree, presumably still stuck on his tusk, a distance of about thirty yards, where he got rid of it. This little diversion had shaken him so much that he did not wait to eat the coconut cabbage, the whole object of his attack on the tree, but left the place where the coconut tree had hit back, and cleared into the jungle.

Animals do sometimes attach any difficulty they get into to the place or locality that they are in and leave it as quickly as they can. I had a *siamang* gibbon (*Hylobates syndactylus*) for many years as a pet and this was a strong trait in his character.

Elephants sometimes uproot trees or push them over when suffering pain from wounds. At one salt lick where I went sometimes to search for tracks I picked up, on one occasion, the tracks of a big elephant which had been venting his rage or searching for relief from pain by knocking over trees in all directions. Although this elephant's tracks were only 24 hours old I never got up to him despite the fact that I followed him for six days. No doubt his abnormal restlessness was due to pain. He finally after leading me over a great extent of country came back to the lick, and as I was no nearer to him then than I was when I started, I went home.

I got this elephant the following year and as one of his tusks had been broken off short and there were recent lesions in the skull in the vicinity of the base of the tusk I connected his behaviour the previous year with these wounds.

It is not a very uncommon thing to bag a bull elephant that has lost its tail or part thereof, I have shot three whose tails have been so mutilated. Malays believe that the bull elephant loses part of his tail by the action of a jealous female which taking him at a disadvantage pulls his tail until it breaks!

It seems to me more likely that these mutilated tails are due to the attacks of tiger when the animals are still young. Tigers do attack young elephants even when nearing maturity. I was hunting at one time up a river where seladang were often to be found. I had made camp and as it was only five o'clock on a fine afternoon I thought, as I had been in a boat all day, that a little exercise would do me good. So I went up the river to a

large abandoned clearing where seladang sometimes fed in the evening. When coming round a bend in the river I saw an animal moving along a sand bar coming towards me. I could only see the top of its back from where we stopped. I climbed up the bank and sure enough there was a young female elephant coming along slowly on the edge of the river. Presently the elephant entered the river and started throwing water all over her, then reaching the opposite bank found a mud hole and squirted the mud all over her back. She looked rather peculiar and examining her with my glasses—she was fifty yards away—I discovered that her right ear was half torn off and her flank was badly scored. These wounds must have been the work of a tiger. She looked pretty woebegone as she passed into the jungle and went on down stream. We had come about half a mile from camp and if she continued the way she was going she would bump right into my camp.

There were three men in my camp and this is what they told me when we got back. One of them had gone down to the river to get water, when looking up stream he saw an elephant only a few yards from him. He did not bother about the water but made best time up the bank, told the others what he had seen and shinned up a tree which was just in front of my tent. The others wasted no time and did the same thing. They were hardly well settled in the branches of this tree, well out of the way of all elephants, when the elephant appeared directly opposite them, crossed to a sand spit where my boat was fastened up, passed the camp and came to a clothes line on which there were some clothes. Here she stopped and the men up the tree in the valour of their ignorance shouted at her. They were quite safe but they never thought of the camp. That shout was too much for her nerves; she gave a little squeal and ran up the bank using the steps I had had cut and arrived actually at my tent door and directly below the tree which sheltered the three brave men

She stopped there a moment and then slowly walked into the forest. She touched nothing, and I was extremely lucky.

Next day I went down the river. During the night the elephant had followed the river for about ten miles, no doubt frequently bathing her sore body. At one place she had lain down on the wet sand. Finally she joined up with the fresh tracks of a herd, which had come from up-river but had not followed it. I expect that this was her herd from which she had been 'cut out' by a tiger.

In addition to the danger to cultivation from wounded elephants travellers in the jungle are also liable to suffer from their depredations.

A river which I sometimes travel up to visit salt licks is frequented by a small herd of elephants that undoubtedly had for sometime a wounded or seriously incapacitated elephant amongst their number. I noticed more than once a peculiar track mixed up with the normal tracks of the herd, and came to the conclusion that one of the elephants had a damaged hind leg, or was hurt

in some way so that it had not proper control over one of its hind legs.

Subsequent to noticing this I was camped on the river bank, on a site often used by me, and having occasion to go farther up the river left some canned provisions and three drums of benzine, well hidden as we thought, in the jungle near the camp site. I was thinking of human marauders, not elephants.

When we came back some five or six days afterwards we found that some elephants had visited the site, had carefully hunted out our 'well hidden' benzine tins, stamped them flat, and finding the provisions proceeded to scatter them about with a malicious thoroughness worthy of a better cause.

The frame of my camp was smashed to pieces and to complete the insult an elephant had tried to make a wallow just in front of where my tent was usually erected.

I had frequently used that camp site and elephants had often been around but, with one exception which I will presently relate, no elephant had ever come close to my camp. Not long afterwards a dead elephant was found on the river bank within a few miles of this spot. It was one of the herd that had raided my camp site and I believe it is permissible to suggest that the herd, normally of good behaviour, were incited by the presence of a wounded elephant to forget their usual good manners.

The other incident was more exciting because we were in camp at the time. At about 2 a.m. I was awakened from a sound sleep by my tent coming down on top of me. I thought that the branch of a tree had fallen on my ridge pole and broken it, and jumping up with a shout I struggled from under the canvas.

A couple of tapir had been round the camp the previous night and one of my men who slept close by, hearing a noise, got up with his electric torch and came towards my tent thinking that he was going to see a tapir or possibly two.

But he got a severe shock when he heard a crack, saw one end of my tent collapse, and the hind quarters of a smallish elephant disappearing into the jungle.

Investigations next morning showed that this elephant, a small tusker still in the playful stage, had come out of the jungle, walked along beside the wall of my tent, then investigated my cook shed which he did not seem to appreciate, turned back following the same route and passed behind my tent the back of which he proceeded to examine. I still slept! While doing this he knocked over a tin dipper which clattered to the ground. This scared him, and turning round hit my tent pole with that part of his anatomy which should never be used as a weapon, and broke it in two. Down came my tent but by that time he was well and truly frightened so made tracks for the jungle. The herd was not far away but the little bull had wandered off by himself as they so often do.

This happened before there was a wounded elephant in the herd, so far as I know.

The Malayan Elephant and his Salt-licks.

I believe that in the Malayan jungles the salt-licks, so widely distributed, are an important factor in the life story of the elephant. But although they have no doubt contributed to the contentment and good health of many species of large game, they have also caused them much suffering and loss through the agency of poachers. A salt-lick is an easy place for a man, with no great desire to work, to sit up and hope for a chance shot at something that may come into the lick, seeking the sulphur water which most of these licks contain.

So for many years some of those Malays who possessed guns took advantage of this habit of wild animals, and hoping to have pot shots either from the safe vantage of a tree, if a large animal such as an elephant, a rhinoceros, or a seladang was the desired object; or from a shelter on the ground it after sambhur or barking deer. An enormous number of animals have been fired at, some killed, but many more wounded, and animals gradually developed a technique which kept them away from salt licks except at night. Then the electric torch appeared on the scene and night shooting in salt licks came into fashion. This would be designated by certain types of mind as 'progress', and it may be from one point of view, but it meant annihilation for the wild animals.

The law in Malaya prohibits these acts but it is weakly administered and these tricks are not altogether checked so far as deer are concerned. Elephants have suffered from being shot at out of trees, as the testimony of skulls that I have give proof, and I think that the large number of elephants with one or even two tusks damaged that have been shot in Malaya, shows that there have been attempts to kill many more elephants than is generally supposed. But other means are used besides sitting up in trees over salt licks. I shot an elephant on one occasion which had five scars on its stomach which had healed up but which must have caused it endless pain and inconvenience when freshly inflicted. These five scars, more or less evenly spaced, were where five bamboo spikes had penetrated its body when going down a steep bank on an elephant trail to cross a river. The excuse for doing these acts is generally that they have been set to keep elephants away from 'cultivation', although there might be no cultivation within miles that counted for anything. I have seen these infernal things set on trails and can imagine how easily an elephant can be injured by them. The trails leading to salt-licks were favourite places for setting traps of various sorts, and it was, I think, on the approaches to the salt-licks or in the licks themselves that most of the harm was done.

I have inspected many remote salt-licks in my time and in all the larger ones I found tracks of elephants. But although I know from such observations that elephants frequently used these licks I have only been able to get photographs of elephants in one lick, in fact have only seen elephants in this one lick.

So my remarks regarding the actual behaviour of elephants in a salt-lick, as seen with my own eyes, refer to one lick, although I have of course been able to read from their tracks in other licks something of what they have been doing during the hours of darkness. The one lick where I have gleaned much from watching elephants is situated in the remote jungles of Pahang, not very far from the main range and is known as *Jenut Lanau*. *Jenut* is one of the words used by Pahang Malays for salt-lick; other words being *Taram* and *Sesap* or *Sesapan,* although the latter word is never so far as I know used for a sulphur-spring lick. In Perak the word used is *Sira*.

Jenut Lanau was a very favourite haunt for poachers a few years ago; it has a great attraction for sambhur and no doubt many have given up their lives in the vicinity of the lick.

Although elephants have been fired at in this lick, I think that owing to it being an exceptionally good sulphur lick, that is to say it has a potent sulphur spring which never seems to run dry, elephants still risk visiting it in the daytime. Also the lick has been pretty well guarded during the last few years. It is within a day's journey of my house!

The reason for so many of the licks being avoided by elephants during the day time is, I think, because their traditions warn them of the danger during the daylight hours. Even at *Jenut Lanau* elephants are often in the vicinity of the lick, but only visit it during the night; in fact most of their visits are at night. There is a very old elephant which sometimes comes to *Jenut Lanau,* but I have never been able to catch him there during the day-time although on several of my visits I have found his tracks and learnt that he had been there during the night. Now there is a story attached to this elephant, which although mostly in the realms of conjecture, is worth relating.

One of the main game trails taking one to or from *Jenut Lanau* follows for a short distance a steepish hill side, the other boundary to the path being a small river that at this point is a short but not very steep waterfall.

I noticed on more than one occasion that when this elephant had visited the lick and had followed this particular game trail, either coming or going, on reaching the steep hill side he left the trail and used the waterfall as his trail. Although it is not steep the rocks are very slippery and I should want to hold on to something if I walked down it. But this old elephant, with its peculiarly careful tread, stepping with great care from flatish rock to flatish rock made his way up or down this small waterfall and then turned to join the game trail again. A very old elephant has a characteristic gait. He walks with great circumspection placing his feet down carefully and cautiously so that if the ground is at all favourable he leaves a very clear and even impress of the sole of his foot. The natives in parts of East Africa have noticed this peculiar trait in old African elephants and the Swahili refer to this way of walking as *'uvendo wa kimgonge'* which means 'the gait of a chameleon', which also walks with a very deliberate tread.

The Asiatic elephant does the same thing and in the low

country, a very distinctly marked track usually showing long toe nails, almost invariably denotes an old beast.

This was the reason why I thought that the track I had seen in *Jenut Lanau* was that of a very old elephant. I was unable to find a single place where I could with any exactness measure the track of his forefoot. He had, wherever there was a piece of level ground, placed with great precision his hindfoot over the impression of his forefoot. I took several measurements of the impression of his hindfoot which taped 18″ in length and 13″ in breadth.

I do not think that this elephant comes very often to *Jenut Lanau,* in fact it is probably merely a visitor not a regular habitué like my friend shown in Plates Nos. 6 and 7.

On one occasion Wan Teh, my assistant camera-man, was sent by me to visit *Jenut Lanau* and I gave him a cine camera to take with him. He had the extraordinary good luck to find two elephants in the lick when he arrived there one afternoon.

Unfortunately there was no hide—the old hide had been knocked down by the young elephants in the herd that frequently comes into the lick—and a Malay is not good at improvising especially in the presence of a wild elephant!

But Wan Teh went to the place where the hide is always built and made a sort of shelter from which he proceeded to photograph the two elephants in the lick. They were both big elephants, but the bigger of the two, who was in possession of the lick, was facing the wrong way round so all Wan Teh got was a good piece of film of his stern. The other one, waiting his turn, wandered about on the outside of the lick but mostly behind trees or masked by the elephant in the lick. He appears in the cine film in one part emerging from the background with a bunch of palm leaves which he is using vigorously to keep off the flies. He had a fine pair of very curved tusks.

The head of the one in the lick was only very occasionally visible when he shifted his position a little. On the right side he had a very long straightish tusk, on the left the tusk had been broken and there was merely a stump in the socket.

Unfortunately the opportunity of examining the tracks was not taken by Wan Teh so I got no measurements of the foot prints. From the cine photograph I have no hesitation in saying that I have never seen either of those elephants in that lick before, but from the pictures it is clear that the one with the broken tusk was an old animal.

When I first noticed the 'elephant's way' I wondered why the tracks went down the waterfall and examined the proper game trail thinking that perhaps there was a big tree or some other obstruction that he wanted to avoid. But there was nothing of the sort, in fact the trail had been followed by a small elephant only a day or so before. This set me thinking; because an old elephant does not go down a slippery waterfall for fun.

I thought of poachers and the convenient contour of the ground which provided a waterfall on one side of the game trail and a steep hill side on the other. In fact the trail was situated in an ideal spot

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for the fixing of a drop-spear, or *penurun* as the Malays call it. The *penurun* is generally made by fixing the blade of a spear or a piece of wood hardened in the fire, into a log of wood which may be anything up to ten or twelve feet long. This log of wood with the spike attached is then suspended over a game trail and a trip rattan is fixed across the trail about the estimated height of an elephant's back. The rattan when pushed by the elephant releases the drop-spear which is connected by an ordinary trigger as used in bird traps, and the spear descends and probably hits the elephant somewhere. The uncertainty of inflicting a mortal wound is great but that did not trouble the poacher; if he got one in ten what did he care for the sufferings of the other nine?

I thought that it was quite possible that this elephant had been hit by a *penurun* when following the trail, had been wounded by it somewhere in the head so as to damage one of his tusk cavities, and had avoided the trail ever since. But as I knew that no *penurun* had been set near that salt-lick for many years, I felt doubtful about ever finding a solution to the reason why the elephant disliked that part of the trail. But after Wan Teh had got a photograph of what I believe must have been the waterfall elephant, I started to think again.

I could see from the projection of the cine film that this elephant had only the stump of a tusk on the left side, and as so many elephants in Malaya break off tusks because of wounds in the head, I thought that perhaps here was the solution to the 'elephant's way' down the waterfall. So the next time I went to *Jenut Lanau* I hunted about to try to get any clue towards the idea of a *penurun*. I could see nothing on any of the big trees which overshadowed the game trail to lead me to believe that they had been cut for the attachment of a drop-spear, but then probably if there had been anything of the sort it would have eliminated years ago. But sometimes one stumbles across evidence quite by accident and I did here. There was a large old fallen tree, many years fallen, right at the commencement of where the trail started to follow the hill side. In fact, when the elephant went down to the waterfall he stepped off the trail and across this tree to reach the stony river bed. I thought I would remove this tree because it obstructed the path and there was a nasty slippery rock directly on the downstream side of it. But I found that this old tree was anything but rotten and it took some work to get it out of the way. While doing this I discovered that far up the tree,—I could not estimate how far—a branch had been cut off and it would have been quite high enough for the attachment for a *penurun*. The *penurun* attachment would have to have a tree on the other side of the track, but I could see no signs of this; it may have rotted away long ago. The only reason why the tree I removed was still there was because it was a hardwood tree which would last for years.

Of course this story is mostly speculation and may not have any relation to the real facts, or have any connection with the elephant and the waterfall; nor may the loss of one tusk have had anything to do with the agency of man. But no man would climb up a big tree to cut off a big branch without some reason

for doing so, so I may not be so far wrong. At any rate it is always instructive to try to reconstruct some happening in the jungle the complete solution of which is bound to defeat one.

But the elephant which has given me more enjoyment in this salt lick than any wild animal I have become intimate with is the bull shown in Plates Nos. 6, 7, 8. I have seen him twice by himself and once with another bull. But his most dramatic entrance and exit was the last time I photographed him.

I was by myself in the hide; Wan Teh having overeaten himself remained in camp with the punishment of a severe stomach ache. I had just got everything ready and had sent the man away who had come with me from camp with the apparatus, when in front of my hide I saw a large bull elephant walking sedately and slowly out of the jungle towards the pool where the lick was. This was at 9 o'clock in the morning, the light was none too good but came from a better direction than the afternoon light which I had always had to utilize on previous occasions.

As this great tusker came into the lick—I saw him almost directly he left the jungle because I happened to be looking in that direction—moving slowly across the grass (maidan), my mind saw in the apparition a great cardboard figure moving with the regularity of a clockwork elephant. It seemed to me for an instant so unreal, so unbelievable, so bizarre, that I had to take hold of myself to get down to earth and action. This is very crudely put but the psychological effect on me was something of that sort.

Had there been the slightest noise the incident could not have affected me in that way, noise means realism, but this great elephant came through the jungle without a sound; as is their wont.

I had a cine camera and two still cameras to look after, rather a handful. They were of course all on stands.

I used the cine as the elephant was coming into the lick but when he was well down to it in the pool I locked the mechanism and left the camera to run. I knew he would not go out of the picture; he was much too busy to leave the sulphur spring or materially alter his position.

When he arrived at the pool, a pool which gets fouled by elephants' droppings, he started to stir up the muck to get it out of the way I suppose, and then felt about with his trunk for the spring which was about two feet below the mud and water. Presently I saw his trunk quivering and then with a mighty blast from his trunk he blew all the dirty water away from the mouth of the spring and got busy. He blew water over his head and his back and between his legs and then started to drink a most astonishing number of times. He was actually in the pool for a quarter of an hour and most of the time he was squirting water down his throat. He was very careful when he put his trunk down to get the exact place where the sulphur water issued from the rocks at the bottom of the pool and I could see quite plainly that sometimes he had difficulty in satisfying himself that he really had got to the right spot. He evidently liked his medicine undiluted.

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I had put down some salt and phosphate someway from the pool as an attraction for deer. The elephant smelt this as I saw him reach out once or twice with his trunk towards where this mixture was; but he made no attempt to investigate.

When he had satisfied his wants he slowly turned round and retraced his steps along the same trail he had entered by and disappeared into the jungle. What so impressed me at the time was that when he came in and also when he went out there was not a sound, and even in the pool it was only when he blew the mud up and once or twice when he bathed himself that there was any noise at all.

This elephant is, as I know from his tracks, a frequent visitor to this lick, as I have already written I have photographed him three times. He is easily identifiable by a bad scar on his trunk between the gums of his tusks, which is shown in the photograph reproduced here. (Plate No. 8.)

I think it is a great privilege to be able to watch any large animal going about its lawful occasions quite unalarmed, and no wild animal is more impressive or gives one a greater thrill than an elephant. It is only possible to appreciate their position and their prestige in the animal kingdom when one sees them, as I have often seen them, in their true habitat, in their natural environment, living as they were intended to live, and filling that function in nature that they have been created to fill.

An Elephant's Salt-lick Party.

Perhaps the most interesting incident that I observed and photographed in this salt-lick in Pahang was when a small herd of elephants came in late one afternoon, the star turn being a small calf and the comic turn being a well-grown bull.

I had two friends with me who had come from Singapore and I took them up to *Jenut Lanau*. They had only three days to spend with me and, unless lucky, three days is too short a time to be at all sure of seeing anything even in that salt-lick.

When we visited the lick we found that a big solitary elephant had been in during the night, so our hopes ran high. But he did not come in again while we were there. As so often happens a small herd followed the big bull and the night before my friends had to get back we were awakened by elephants trumpeting from the direction of the lick. It was bad luck on my friends that the elephants were a day or two too late. Before they left in the early morning I took them down to the lick but the elephants had gone. However they were able to see how they had enjoyed themselves in the lick. Obviously this small herd had been in the lick most of the night.

Later in the day I went to the hide and set up my apparatus. At four o'clock in the afternoon I heard the elephants trumpet and again at half past four, but nothing happened until five o'clock when, with a little scuffling noise to my right as the elephants crossed the small stream which runs in front of my hide, three

elephants walked quickly across my front and plunged into the pool. Plate No. 1 shows them as they started to drink in the lick. The small calf, as it came into the open between the two cows, had all its time cut out to keep up but they arrived together and as can be seen by the photograph all drank together. I was busy with my cine camera when my assistant touched me on the arm and said, 'Here comes the bull', and sure enough on the trail which the cows had followed was a good sized bull with poor tusks.

He did not attempt to enter the lick where the cows were but turned short right, went all round the fallen log a portion of which can be seen in the photographs of the lick, and came in from the far side. But the cows had the front seats and I presume, from watching the proceedings of the big bull as shown on Plate No. 7 where he is trying to find the exact place where the sulphur exudes from the rocks, that they were disinclined to give up their good places to any intruder.

Now the bull could have pushed the big cow out of the way very easily if he had wanted to do so, but perhaps elephants are like human beings and very often the lady wears the trousers so he made no attempt to use his great strength to get at the right spot in the lick. But he gently pushed and pushed at the cow, sometimes with his forehead and sometimes, very gently, with his tusks. But although as can be seen in Plate No. 2 he pushed the cow slightly out of the perpendicular he achieved nothing. In the meantime the other cow, the *pengasoh,* was stirring up the mud and making as much mess as she could. The calf did not like this so backed out from between the two cows and went off to explore for himself. He was still quite small and as can be seen from the photograph was still suckling. His little undeveloped trunk waved about, he touched the tree which was directly in front of him several times with the tip of his trunk not quite certain perhaps whether it was something good to eat or not. In fact he did not know what to do with himself.

Presently two other elephants came to the edge of the jungle, but not within clear view, and turned away to one side, not coming into the lick. Perhaps they saw that the house was full; anyway so long as I was there they did not appear again. The bull in the lick seemed very uncertain what to do: the cows ignored him and carried on. I do not think he appreciated this because he started stirring up the mud, occasionally throwing water over himself and incidentally the cows, in fact generally making a nuisance of himself. Then he started to wave one of his forefeet in the air just above the water with a circular motion of his foot. Sometimes he just touched the water skimming the surface. He did this for some time but what he was trying to do was beyond me. Any scum that may have been on the water had been mixed up long ago by the cows; I think it was just annoyance and indecision as to what to do about it. Soon my films were used up and as it was getting late and the light almost gone we packed up and left the elephants to it. Just as we were leaving I turned back to bid the elephants a pleasant evening when I noticed that they

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had all turned round and were now facing the hide. But the bull was still an 'also ran' the cows sticking to the best places.

Next morning one of my men went down to the lick and found an old cow in possession. I went down a little later and the indications in the lick showed that the elephants had been there most of the night. But we had to go down river that morning because I had to pick up my other boat on another river about noon, so we left the elephants to enjoy their salt-lick party. I expect the bull got there finally—its a way they have—but he certainly was exceptionally polite and was a good example to *Homo sapiens.*

Conclusion.

Well, we will leave the Malayan elephant for the present and hope for the best.

They can well look after themselves in Malaya's luxuriant jungles if they are given a fair chance to do so, and so long as there are properly guarded sanctuaries of sufficient area to accommodate them, they will survive.

But 'progress' in Malaya, which means commercialism *in excelsis,* is no friend to wildlife.

Unless public spirited and independent persons, who know and appreciate the value of wildlife from educative, recreative, and aesthetic standards, will fight for the proper preservation and intelligent conservation of the elephant, and the seladang, the rhinoceros and the sambhur deer, Malaya, with its polluted rivers, its mining wastes, its ever increasing erosion, its uneconomic forest exploitation, will become in a few decades a zoological wilderness, and the larger types of the fauna will become memories only.

Appendix.

The following particulars of weights and measurements of tusks of the Malayan Elephant are given to support the contention in my introduction that the Malayan Elephant is not inferior to the Indian Elephant regarding the tusks it carries.

The tusks recorded under No. 1 are very exceptional for Malaya; the others may be considered as typical of mature tusks although No. 2 is rather above the average.

No. 1 was obtained in Johore during the last four or five years, the others in Pahang, twenty to thirty years ago.

Generally speaking the elephants near the coasts carried the heaviest ivory, but No. 3 was a mountain elephant and is mentioned in my narrative.

Schedule.

	Length outside curve		*Circumference at gum*		*Weight in lbs.*	
	Right	*Left*	*Right*	*Left*	*Right*	*Left*
No. 1	7′ .5¼″	6′.10½″	17¾″	18″	75¾	70
No. 2	5′.10″	5′.9½″	15″	16″	44¾	46
No. 3	4′.10½″	4′.10″	15½″	15½″	38	37
No. 4	5′.6″	5′.2″	15½″	15″	36	32

THE EARLY STAGES OF INDIAN *LEPIDOPTERA.*

BY

D. G. SEVASTOPULO, F.R.E.S.

PART VII.

(*Continued from page 294 of this volume*).

GRYPOCERA.

HESPERIINAE.

Syrichtus galba F.

Head round, rusty black, and sparsely clothed with longish coarse black hair. 1st somite slender, orange, edged posteriorly with black and with a median yellowish-white stripe. Rest of the body bluish-green, with a slightly darker dorsal stripe, and covered with white granules. Body clothed with moderately long white pubescence, the 1st somite in addition with black hairs similar to those on the head. 1st pair of legs blackish, 2nd and 3rd pairs and prolegs bluish-green. Lives in a folded leaf.

Pupa in a folded leaf lined with white silk. Of the usual Hesperid shape. Thorax bluish-green, wing cases green and abdomen pale pinkish with a subdorsal series of greyish spots. The whole body subsequently develops a dense white bloom giving it a general pale lilac appearance. The following markings are not obscured by the bloom—a large black spot on the thoracic spiracle, two small black spots on the vertex of the head and a blackish streak across the eye. Except for the wing cases, fairly thickly covered with moderately long white hairs. Anal end enclosed in the cast larval skin, which is attached to the silk lining of the leaf.

Food-plant—*Sida rhombifolia* Linn. (Malvaceae).

Described from a full-fed larva found in Calcutta 15-xi-40, pupated 18-xi-40, and a male emerged 25-xi-40.

HETEROCERA.

THYRIDIDAE.

Striglina scitaria Wlk.

Moore, *Lep. Ceyl.*, iii, 206, pl. 175, fig. 1a. 1884-87.

Hamps. *Fauna Brit. Ind.*, Moths, i, 354. 1892.

Head large, very dark brown. Ground colour of body greenish-yellow, with a darker green dorsal line due to the contents of the intestine shewing through the skin. 1st somite posteriorly with a raised black transverse line, divided centrally. 1st to 3rd somites

each with a raised black sublateral dot. 2nd and 3rd somites each with a double raised black spiracular dot, a larger subdorsal dot and a still larger one between it and the spiracular dots. 4th to 10th somites each with a double raised black spiracular dot, a subdorsal dot and another slightly above and anterior to it. 11th somite with four raised black dorsal dots and a spiracular one. 12th somite with a transverse row of four rather larger raised black dots. Anal flap edged with a raised black line. A few white hairs. Legs, prolegs and venter yellowish. Lives in a silk-lined cell in a folded leaf. Before pupation the ground colour turns bright canary-yellow.

Pupa in a spun together leaf lined with white silk. Dark reddish chestnut. A slight projection between the eyes. Slightly waisted between the thorax and abdomen. Spiracles set in very large, deep cavities. Cremaster, consisting of a bunch of hooked spines, fixed in the silk lining of the leaf.

Food-plant—*Phaseolus* sp. (Leguminosae).

Described from a full fed larva found in Calcutta 6-i-41, pupated 9-i-41, and a male emerged 19-i-41.

Moore's description is 'Larva with 16 legs; cylindrical; with a few fine short dorsal hairs; olivaceous, with a few transverse series of black dots on third to last segment; second segment ochreous; head blackish. Pupa dark purplish brown.' Hampson's description follows this very closely, except that it is the first segment which is described as ochreous and the spots are said to be on the second to terminal segments.

LYMANTRIIDAE.

Leucoma submarginata Wlk.

Moore, *Lep. E. I. Co.*, 336, pl. 14, fig. 11a.

Hamps., *Fauna Brit. Ind.*, Moths, i, 487. 1892.

Strand Seitz, *Indo-Austr. Bombyces*, x, 311.

Ovum round, rather flattened, the micropylar area depressed. Unsculptured. Bright translucent green when laid, after twenty-four hours the green becomes duller and a dark red-brown ring develops round the upper edge under the chorion. Turns brown shortly before hatching. Laid singly or in twos and threes. Hatched on the sixth day.

Newly hatched larva with the head and body greyish white, a subdorsal dark grey stripe broken on the 1st, 8th and anal somite by a transverse band of the ground colour. Hairs white. Does not eat the eggshell.

Final instar—Head velvety black, the clypeus filled in with white. Body velvety black, a series of lateral white spots, varying considerably in size, and a white transverse dorsal line between the 1st-2nd and 2nd-3rd somites. A second form is similar except that the lateral white spots are obsolete and there is a double greyish white dorsal stripe between the 4th and 11th somites, interrupted on the 7th. A third form has the head brick red, the clypeus outlined with black and filled in with white. Ground colour black with a series of numerous transverse pale greenish yellow

lines. A sublateral series of slightly oblique, pale greenish yellow lines, the whole forming a broken sublateral line. In all forms, 1st somite with a black subdorsal tubercle tufted with greyish hair. A double dorsal and a subdorsal series of rosettes of short greyish hair, a single dorsal tuft of longer black hair on the 3rd, 7th and 12th somites. A sublateral series of rosettes of medium length grey hair. Thoracic and anal somites with single long greyish hairs. Legs and prolegs brownish. Dorsal glands greyish. Venter dark grey.

Pupa in a slight net of white silk. Typical Lymantriid pupa in shape. Colour pale frosted green, the spiracles black. Cremaster a pale brown blunt spike, armed with minute hooks, and fixed in the silk of the web.

Food-plant—*Lagerstroemia indica* Linn., but this is probably not natural as only three larvae reached maturity and these were very undersized. The newly hatched larvae were offered *Terminalia catappa* and Mango, said to be foodplants of other species of the genus, also *Quisqualis indica* and Peepul, but refused to feed.

Described from larvae bred from ova from a Calcutta caught female, one of which pupated 11-i-41, and a male emerged 16-i-41.

Hampson's description is as follows:—'Larva pale fuscous, with long, scattered, simple, and spatulate hairs; a dorsal tuft of long black hair from the second somite; subdorsal and sublateral black lines; the first and second somites banded with black in front; the second somite with a yellow band also.' Seitz gives an almost identical description and adds 'Pupa green with black spots on each side of the thorax, somewhat flattened and curved, suspended in some netted threads.'

NOCTUIDAE.

Spodoptera pecten Guen.

Ovum pale bluish-green, spherical with the base flattened, and with numerous ribs running from the micropyle to base. Laid in large batches, sometimes two or three layers thick, and covered with hairs from the anal tuft of the female. Hatched on the fourth day.

Newly hatched larva with a honey-coloured head, body greyish with minute black specks and sparse black hairs. After feeding the ground colour becomes green.

Half grown larva with a honey-coloured head, body smooth, green with a dorsal and subdorsal white line and sublateral white stripe. In some examples the sublateral stripe is edged above with dark reddish brown, and in a very few there is a reddish brown dorsal stripe in place of the white line.

Larva in penultimate instar very variable. Head honey colour with an inverted dark V-shaped mark. Body greyish-brown with a paler dorsal and subdorsal stripe, a paler sublateral stripe edged above with darker. *Or* with a broken black line above the subdorsal stripe. *Or* with a broad yellowish-green stripe below the subdorsal stripe, which may or may not be edged above with a

broken black line. Venter greenish-brown in the brown forms, green in the forms with the green stripe.

Full grown larva—Head olive-brown with an inverted whitish Y-shaped mark, the area between the arms honey colour. Ground colour of body pale brownish-grey or greenish-grey. A paler dorsal and subdorsal stripe, the latter edged above with a series of black lunules, and a pale spiracular stripe edged above with a purple stripe. 1st somite with a dorsal plate with a white dorsal and subdorsal line. Legs pale brown. Venter and prolegs greenish-grey. Spiracles black.

The larva is very similar to that of *S. mauritia* Bsd. (mihi, *Journ. Bomb. Nat. Hist. Soc.*, xl, 687) but is slightly smaller.

Pupa subterranean in a slight earthen cocoon. Bright red brown, a dorsal stripe on the abdomen and the intersegmental rings darker. Cremaster a double spine.

Food-plant—Grasses.

Described from a number of larvae bred from ova from a Calcutta caught female, one of which pupated 27-xi-40, and a female emerged 5-xii-40.

Spodoptera cilium Guen.

Ovum greyish-green, spherical with the base flattened and with numerous ribs running from the micropyle to base. Laid in fairly large batches and covered with hairs from the anal tuft of the female. Hatched on the fifth day.

Newly hatched larva grey, the head black. Hairs dark. Turns greenish after feeding.

2nd instar—Similar, but the head very pale honey-brown.

3rd instar—Similar. A faint white subdorsal and lateral line, a whitish subspiracular stripe. A number of minute black dots.

4th instar—Similar.

5th instar—Similar, the subspiracular stripe, in most examples, edged above with dark brown. Some with the dorsum tinged with reddish brown, extending in a few examples all over the body. Later a subdorsal series of black lunules usually develops.

Final instar—Head dark olive-brown, a pale inverted V-shaped mark, the arms filled in with paler olive-brown. Body dull drab, a narrow paler dorsal and subdorsal stripe, the latter edged above with a series of black lunules almost obsolete on the 1st-3rd and 11th-13th somites, and a narrow dark purplish spiracular stripe edged below with paler. Venter greenish. Legs and prolegs greenish. Spiracles black. A second form is similar except that the subdorsal stripe is tinged with green, and the area between it and the spiracular stripe is pale green. The black lunules are sometimes obsolescent, or even obsolete, those at the ends disappearing first.

It is, perhaps, interesting to note the sequence of colour changes in the larvae of this species, *S. pecten* and *S. mauritia*. The first instar larvae of all three species are alike, except that the head is black in *cilium* and *mauritia* and brown in *pecten*. After the first ecdysis the head is brown in all three species

and there is little change in appearance up to the 4th instar in *cilium*, the 3rd in *pecten* and the 2nd in *mauritia*. The following instar brings the beginning of the brown colouration and this is intensified in the next, the green colour disappearing in the 5th instar in *mauritia* and in the 6th (final) instar in *pecten*, but persisting in the 6th (final) instar in *cilium*.

Pupa subterranean in an earthen cocoon. Yellowish brown, the wing cases tinged slightly with greenish. A trace of a dark dorsal line along the abdomen and with the intersegmental areas darker. Cremaster a pair of diverging stoutish spines.

Food-plant—Grasses.

Described from larvae bred from ova from a Calcutta caught female, one of which pupated 16-i-41, and a male emerged 28-i-41.

Both Hampson (*Cat. Lep. Phalaenae*, viii, 254. 1909) and Warren (Seitz, *Indo-Austr. Noctuidae*, xi, 321.) treat *cilium* as a synonym of *S. abyssinia* Guen. and give the following description of a Natal larva under this name:—'Ochreous with numerous pale points defined by pale brown; dorsal line orange; subdorsal line represented by a series of orange marks defined by irregular black lunules above; lateral line represented by orange marks; the stigmata black with brown patches above them; head and thoracic plate red-brown.'

Sideridis insularis Btlr.

Ovum pale yellow with slight mother-of-pearl reflections. Round, unsculptured. In captivity laid in the angles of the box, in a state of nature presumably, as other members of the genus, in the axils of grass. The position results in the shape being badly distorted and the ova appear to shrivel before hatching. The colour slowly darkens to deep yellow and finally turns a dull leaden grey a few hours before hatching. Hatched the fifth day.

Newly hatched larva grey with a honey-coloured head, the body turning green after feeding. A few short white hairs.

2nd and 3rd instar larvae—Head honey-brown. Body greenish-grey with ten longitudinal dark lines and a white subspiracular stripe.

4th instar—Head olive brown, the clypeus with a central black streak and with a black line on either side. Body with a greenish white dorsal line edged with dark green, a subdorsal dark green line with a narrow whitish stripe below it, below this a broader purplish-brown stripe, a pale green line and then a black-edged dark green stripe. A whitish spiracular stripe containing a brownish central stripe. Venter greyish green. Legs blackish. Prolegs greyish green with an apical dark mark. Before ecdysis the colour fades and the larva is dull drab with dark lines.

5th instar—Head as in previous instar. Ground colour dark green tinged with purple. A white dorsal and subdorsal line, the dorsal edged with darker green, the subdorsal with a purplish stripe below it. A greenish white lateral line with a very dark green stripe below it. A spiracular white stripe with a rust coloured stripe inside it. Venter greyish green. Legs and prolegs greyish green, the latter with an apical dark mark.

Final instar—Head honey-brown, a black line on either side of the clypeus and the sides with a honey-comb pattern in black. Body with a broad grey dorsal stripe, within which is a central white line edged with blackish. A white subdorsal line edging the dorsal stripe, above which is an interrupted black line. Beneath the white subdorsal line, a pink stripe, a grey stripe and then a paler pink stripe, all separated by white lines, and a white line below the paler pink stripe. Venter pale greenish. Legs and prolegs pale greenish, the latter with an apical dark mark. Spiracles black. The greys, black and pinks are not pure colours but composed of streaks and specks on a whitish ground. When completely full fed, the greys and black strongly tinged with green.

Pupa subterranean in an earthen cell. Bright reddish chestnut, the venter and wing cases slightly paler, the thorax, a stripe down the dorsum and the intersegmental rings slightly darker. Cremaster a pair of stout spines with a finer hooked spine on either side and a pair of fine hooked spines immediately behind on the dorsum.

Food-plant—Grasses.

Described from larvae bred from ova from a Calcutta caught female, one of which pupated 31-xii-40, and a male emerged 12-i-41.

Prospalta pallidipennis Warr.

Head pale green, the sides tinged with crimson and speckled with white. Ground colour pale yellowish green. 2nd and 3rd somites each with a transverse series of eight minute white dots. 4th to 10th somites each with a subdorsal triangle of three crimson-ringed white dots. A white spiracular stripe, speckled minutely with crimson and edged above by a crimson line. A white dot, with or without a crimson ring, over each spiracle above the spiracular stripe. 11th somite slightly conical with a whitish dorsal and subdorsal blotch, the area between whitish speckled with crimson. 12th and 13th somites marked with crimson dorsally. Spiracles black. Legs brown. Abdominal prolegs with a blackish spot at base, the apex speckled with crimson. Anal claspers marked with white in continuation of the spiracular stripe and slightly crimson speckled. Venter and area below the spiracular stripe rather bluer green. Before pupation the dorsum becomes suffused with purplish.

The above is the form found wild. When reared in captivity, however, this form does not appear, the following two forms taking its place.

Head brown, the sides dark purple brown speckled with white. Body with the ground colour above the spiracular stripe a rich bronzy brown (turning to deep crimson in blown specimens) with markings similar to the first form. In addition there is a series of oblique dark lines forming a dorsal and subdorsal series of diamond shaped marks. The crimson round the white dots and above the spiracular stripe somewhat obscured by the ground colour. The spiracular stripe whitish speckled slightly with crimson, the area below and venter pinkish grey.

The third form is pale yellowish green with the usual crimson markings very pronounced and, in addition, a broad, irregular,

diffused crimson dorsal stripe formed of conjoined blotches, the legs springing from crimson patches and the prolegs crimson.

The larva is very similar to that of *P. capensis* Guen. (mihi, *Journ. Bomb. Nat. Hist. Soc.*, xlii, 43) but can be distinguished by the white speckled side of the head and the subdorsal blotches on the 11th somite, *capensis* having a plain black stripe on the side of the head and no subdorsal blotch on the 11th somite.

Pupa subterranean in an earthen cell. Head, thorax, wing, leg and antenna cases olive green. Abdomen brownish yellow with an olive green dorsal stripe and an olive green line on the posterior edge of each somite, the intersegmental area purplish brown. Cremaster two short spines.

Food-plant—*Coreopsis.*

Described from a full fed larva found in Calcutta 10-xi-40; buried itself 11-xi-40, and a male emerged 19-xi-40.

Geometridae.

Hyposidra talaca Wlk.

Moore, *Lep. Ceyl.*, iii, 392, pl. 185, fig. 1b. 1884-87.

Hamps., *Fauna Brit. Ind.*, Moths, iii, 213. 1895.

Immature larva—Head round, black. Ground colour of body blackish purple, a paler dorsal stripe from the 9th somite backwards. A transverse row of white dots between the 4th-5th, 5th-6th, 6th-7th and 7th-8th somites, the first row extending right across the body from the sublateral area, the lower portion somewhat oblique, the other three rows on the dorsum only. Legs black. Shape rather short and stout.

Full grown larva—Head round, pale brown speckled with darker. Ground colour pale brown speckled with darker and with orange. 1st to 4th somites each with a small subdorsal orange patch, that on the 4th largest. 11th somite also with a small subdorsal orange patch. Legs purplish-red banded with paler. Venter coloured as dorsum with a double median line of orange specks. The area between the legs and claspers whitish.

Pupa subterranean in an earthen cell. Colour reddish-brown, the wing cases more yellow. Cuticle polished, the abdomen minutely punctate. Cremaster a stout spine.

Food-plant—Castor (*Ricinus communis* Linn.).

Described from a larva found in Calcutta, pupated 19-xii-40, and a male emerged 4-i-41.

Moore's description is:—'Larva with ten legs; pinkish olivaceous-green, minutely black speckled; with a blackish lateral spot on the fifth and seventh segments. Pupa olivaceous-green and reddish. Feeds on *Jambona, Combretum,* and *Ficus parasiticus.*' His figure shews a pale coloured larva with an indistinct black ring on the 4th somite and a black figure-of-eight on the 6th. The pupa is depicted as brownish with green wing cases. Hampson's description is:—'Larva pinkish olive-green, irrorated with black, and with dark patches on 4th and 6th somites.'

Thalassodes quadraria Guen.

Head green, bifid. Ground colour of body green, in some cases with a diffused dull crimson dorsal stripe, which may sometimes only be apparent between the somites. Legs and prolegs green. Anal flap triangular and ending in a sharp point.

Pupa between two leaves spun together with thick strands of white silk and attached by the cremaster to a few threads of silk. Shape slender, the head square across. Colour a uniform pale green. Cremaster a stout spike armed with hooked reddish spines.

Food-plant—*Polyalthea longifolia* Wall. (Anonaceae).

Described from a full fed larva found in Calcutta 17-xi-40, pupated 19-xi-40, and a male emerged 24-xi-40.

Moore (*Lep. Ceyl.*, iii, 426, pl. 194, fig. 2a. 1884-87) figures and describes the larva of *T. dissita* Wlk., which Hampson considered as conspecific with the present species. This description is as follows:—'Larva with 10 legs; looped; slender; head bifid; a pointed prominence on 12th segment; colour reddish above, greenish beneath; legs red. Pupa pinkish, greenish in front; thorax and abdomen minutely black-speckled. Feeds on Barringtonia.'

(*To be continued.*)

SALT-LICKS.

Their Vital Importance to the Conservation of Wildlife in Malaya.

BY

Theodore Hubback.

The successful preservation of Wildlife is intimately connected with ecological study.

Salt-licks are embraced by such study. To provide a congenial environment for the successful and normal production of the various species of large Wildlife found in a Malayan Jungle the environment must include some type of soil, or exudations from the soil, which form salt-licks for such animals as elephant, seladang, rhinoceros, tapir, sambhur, and barking deer.

The term salt-lick may be considered as a generic one. It is used to indicate any soil in which some natural substance is found which is attractive to wildlife and which they eat or drink. It is probably taken as a medicine, and undoubtedly acts as an aperient.

In Northern Pahang, there have been many places where from time immemorial wild animals and even birds have been accustomed to utilize certain exudations from the soil. The extent to which some of these places have been used, is clearly indicated by the trails leading thereto, they show how important they have been to the life and well being of generations of jungle inhabitants.

The most popular licks are those which have been centered round sulphur springs. Some licks are mud-licks. They do not appear to contain sulphur, but are impregnated with some saline which for want of analysis I am unable to identify.

In Pahang the important salt-licks near the main range are all sulphur springs. In one place, well in the foot-hills of the mountains, there is a hot sulphur spring, much too hot for the animals to drink from, so they have made a lick somewhat below the spring where the sulphur water has cooled down.

Many of these licks in Northern Pahang—I will describe some of them—are still being used, but in most cases, owing to circumstances that I will indicate, they have fallen from the position that they occupied a few decades ago.

The first and most important reason why they have become less used is because of the alarming decrease in the incidence of the larger wildlife. In addition to a cumulative decrease going back for some years, there has been, during the last five years or so, much disturbance throughout nearly all the river valleys by gold stealers and jelutong tappers—in many cases the same people—that a congenial environment has been denied to the larger wildlife and normal breeding has not taken place. The extraordinary decrease in the numbers of sambhur deer which cannot be accounted

for by hunting, legitimate and illegitimate, can only be due to the failure to breed in the usual sequences because of continual disturbance.

All this has affected the salt-licks; still, if our larger wild animals are to be saved from extinction—wildlife is supposed to be preserved now—it must be part of the ecological studies of those whose duty it is to enforce the preservation laws, to devote time to the question of the salt-licks and to appreciate their great importance in the life cycle of our larger fauna.

It is my earnest hope that by describing some of these licks I may stimulate those whose responsibility it is to save our decreasing wildlife to devote more time to these most important phenomena. Such study will help them to realize their real importance to the cause of preservation and the contentment of the wild creatures of the jungle.

The Telom Valley

Jenut Lanau

Probably at the present time the most important salt-lick in Ulu Pahang is Jenut Lanau in the Sungei Telom Valley. This lick consists chiefly of a sulphur spring amongst some rocks at the bottom of a pool, some two feet deep. This spring never runs dry and is a permanent attraction to elephant and sambhur deer. Seladang some years ago used this lick regularly, coming over generally from the direction of the Jelai Ketchil Valley. Now only one old bull ever visits the lick, and even then only for a day or two during the year.

But elephants and sambhur deer use it continuously, especially elephants. I have identified eight tuskers in that lick, but possibly I may have counted one twice over. But I have certainly not seen every male elephant that visits the lick. Female elephants look so much alike that I should not like to say how many I think I have seen.

This lick is an ideal one to visit for the purpose of photographing wild elephants and sambhur. But when elephants are about, sambhur do not like the lick, and generally keep away. Elephants make such a mess of the pool, and sambhur being unable to get their mouths right down to the springs—they do their best at times, putting their muzzles into the water right up to their eyes—object to a mixture of diluted sulphur water and elephants' excrement.

I have seen as many as five sambhur in the lick together, an unusual sight in this country. I have never seen a big stag in Jenut Lanau. This is due to the considerable amount of poaching that has gone on in this lick up to a few years ago.

The landing place for Jenut Lanau can be reached from the railway station at Bukit Betong by motor-boat in a day unless the Jelai River is in flood.

Jenut Misong

Another important lick in the Telom Valley is Jenut Misong, a day's journey up river from Jenut Lanau. The last six or seven miles from Kuala Sungei Perahu, the end of navigation, is made

by jungle path. The Jenut is about a mile from the left bank of the Telom River.

Jenut Batu

This lick, some thirty years ago, was a great place for deer shooting from hides; on the ground and up trees. It was so good that now few deer can be found there. But elephant utilize it a great deal, as well as another small lick known as Jenut Batu, about a mile further up the Misong Valley.

The principal attraction at Jenut Misong is sulphur impregnated sand on the left side of the river, which the elephants dig up to get at a more concentrated solution of sulphur deeper down.

Seladang used to occasionally visit this lick, but those days have passed. It is doubtful if any seladang herd can now be found in the Upper Telom Valley. It must be remembered however that with the continual disturbance that is going on in all these valleys, solitary seladang are liable to travel long distances from their regular beats and the discovery of a seladang in Jenut Misong must not be taken as indicating the return of a herd to its old haunts.

The Serau Valley.

The Serau River together with the Telom and Jelai Ketchil are the confluents of the Jelai River.

In the Valley of the Serau there are, what were a few decades ago, several important salt-licks. They are now mere derelicts of their former pristine value; not because the localities where they are situated have been developed, they are still in their virgin jungle; but because the chief frequenter of these licks, the Sumatran rhinoceros, has been poached almost out of existence. I will give a brief description of each lick.

Jenut Batu Dada

In the Serau itself there is one lick, Jenut Batu Dada, which is still very occasionally visited by an old male rhinoceros. This is veritably 'the last of his race' so far as that lick is concerned. From the indications in the vicinity of the lick, this place must have been used by dozens of rhinoceroses before they were destroyed by poachers and their infernal pits. Deep unused trails, abandoned wallows, banks cut into by innumerable rhinoceroses' horns and feet, all testify to the glories of this recreation ground of animals long since passed away.

There is a large pool in the centre of the clearing which constitutes the surroundings of this lick. This pool contains several sulphur springs. It is almost completely surrounded by well-polished rocks, polished by the action of generations of wild animals. I have seen rhinoceros, sambhur, kijang, and wild dogs in this lick, as well as a Malay serpent eagle, which seemed to enjoy the sulphur water with the best of them. Elephants very occasionally visit the lick. Tapir also use the lick but not seladang.

Jenut Lyong

The Sungei Besay, a large tributary on the right bank of the Serau, had three good salt-licks at one time. Jenut Lyong, not very far from Kuala Besay, is still visited by elephants.

Jenut Patchat, is a small lick on the left bank of the Besay above Jeram Limau. This lick used to be visited by rhinoceros; but they go there no longer for the excellent reason that there is none to go. **Jenut Patchat**

The most important lick in the Besay was Jenut Bliong; far up in the foot hills of Gunong Bedong. There were two very active sulphur springs in that lick. **Jenut Bliong**

From the indications still in evidence, this lick must have been used by rhinoceroses in some numbers but is seldom if ever visited by them now. I advisedly write 'seldom' because there is no reason why the old rhinoceros who visits the Jenut Batu Dada should not visit Jenut Bliong—they are not more than twenty miles apart in a straight line—although I have no evidence to support such an idea.

Elephants still use this lick. The Besay rises in Gunong Bedong and extensive pitting for rhinoceros was done in the foot hills some years ago. I have seen pits well up the mountain. No doubt the breeding stock was so depleted that rhinoceroses were not left in sufficient numbers to maintain a normal breeding rate. That means extinction.

Above Kuala Besay there is on the left bank of the Serau a large tributary known as the Briang. About three miles from Kuala Briang, situated on both sides of the river Briang, there is a large salt-lick, the Jenut Briang. **Jenut Briang**

On one side of the river there is sulphur impregnated sand, and on the right bank a rampart of limestone outcrop in which there are sulphur springs.

Around this lick I found no less than 18 old rhinoceros pits, which alone show that many rhinos must have used this lick. This lick has not been visited by rhinoceroses for very many years, but the lick is used by elephants and sambhur, and very occasionally, seladang. It is an extensive lick with many old game trails, deeply worn, leading into it. The rocks on the right bank of the river have been polished almost to perfection by the action of elephants and rhinoceroses using this lick in years long gone by.

Above the confluence of the Chadu and the Serambun, which form the Serau, there are two sulphur licks. One known as Jenut Batu Karam, on the left bank of the Chadu, has been entirely ruined by mining, mostly unlawful. **Jenut Batu Karam**

The second, known as Jenut Batu Papan, is far away up the Serambun within a couple of miles of the Kelantan Border. This lick was once a very favourite haunt of rhinoceros, but here again poachers did their deadly pitting in the early part of this century and the Serambun Valley now holds few rhinoceros. **Jenut Batu Papan**

I found no less that 14 old rhino pits round this lick, but no doubt neither here nor round Jenut Briang did I find anything like all the pits that had been made. Within the last ten years poachers have come over to this lick from Kelantan. I have myself seen the

remains of a platform built in Jenut Batu Papan, which the local Sakai informed me had been built by Chinese poachers from Pulai.

Jenut Batu Papan consists of a sulphur spring amongst some rocks, alongside the small stream that runs through the lick. But what was undoubtedly an attraction as well was a 'battery' of mud wallows close to the lick situated under the toe of a steep hill side. There were eight of these wallows quite close together. Two of them are still used, but only very occasionally. It is possible that there is a small modicum of sulphur in these wallows which made them so attractive to rhinoceroses.

An old male rhinoceros sometimes uses the wallows but does not patronize the lick very often. Tapir are fond of this lick and I have seen the tracks of serow (*kambing grun*) in the sand near the sulphur spring. I have seen rhinoceros, tapir, and also a serpent eagle in this lick.

The entire jungle for miles and miles in Pahang and Kelantan is unoccupied by any human inhabitants and the environment of the Serambun Valley is exceptionally suitable for rhinoceroses. But for years, when intensive poaching was going on, there must have been no normal breeding and the seriously depleted stock now shows the results.

Still, in the Serambun Valley, an area of about 30,000 acres, there is a very small stock of rhinoceros which might be saved with careful conservation. I have identified, a few years ago, five head which included one calf. I applied for this entirely unopened and unoccupied area as a rhinoceros reserve, but someone whispered the magic word gold, and when there is any mention of possible gold exploitation no other subject is considered for a moment!

The Serau and its tributaries are the only hope for the rhino in Ulu Pahang, with the one exception of that portion of the upper waters of the Tanum River, which lie within the King George V National Park area. But the environment there is not so suitable as that in the Serau. In the Telom and Jelai Ketchil Valleys there are no rhinoceros at all.

The Jelai Ketchil River.

Jenut Stein

In the Jelai Ketchil River the Jenut Stein is a well known and important salt-lick. It is much favoured by sambhur deer and until a few years ago by seladang. The seladang in the Jelai Ketchil have been so much disturbed by jelutong tappers that they have broken up into small groups and undoubtedly have not been breeding normally. It must be recognized that seladang are often attacked by tiger if they are found in small groups accompanied by a calf, and undoubtedly disturbance, which helps to break up the herds, is of assistance to the tiger who is able to take a greater toll of calves than he can under conditions more favourable for the seladang.

A few years ago a hut was built by two Chinese between Jenut Stein and Jenut Kahamang, a small lick about a mile away up stream from Jenut Stein. The hut was built right alongside the main game trail. **Jenut Kahamang**

These Chinese were supposed to be jelutong tappers which trade they no doubt exercised spasmodically, but they also ran an illicit still and sponged on the Sakai. To serve their illegal ends they distributed some of the liquor to the Sakai.

The lick was entirely deserted by seladang for over two years because of the continual use of their trails, the smell of human occupation which tainted the approaches to the lick, and the disturbance caused by trails which these Chinese made round the lick.

Jenut Stein consists of sulphur impregnated sand over an area of several hundred square feet, with a small stream meandering through it. Elephants were very fond of the lick until the locality was tainted by the activities of these Chinese, but during the period of the Chinese occupation they also deserted the lick. This is a good argument for proper protection of these licks. The elephants are back again now and occasionally visit the locality. They dig deep holes in the sand to try to find the best places.

Jenut Tebarau, a small lick near the end of navigation up the Jelai Ketchil River, is badly situated between two steep hill sides. It is rich in sulphur springs and at times is much used by seladang. **Jenut Tebarau**

Beyond Jenut Tebarau, far above the series of cascades that constitute the upper waters of the Jelai Ketchil, there are two hot sulphur springs which are used as Jenut. One known as Jenut Gatak—I have mentioned this lick on page 2—is used by elephants and very occasionally seladang. **Jenut Gatak**

The other spring, known as Jenut Mesai, is near Jenut Gatak but is seldom used by wildlife. **Jenut Mesai**

The Telang Valley.

There is one important salt-lick in the Ulu Telang area known as Jenut Blimbing, situated in the Ulu of the Sungei Sergi, a small tributary of the Sungei Tengalan which joins the parent river near Kuala Tengalan. **Jenut Blimbing**

This lick is a mud-lick, there being no apparent indication of sulphur. It has been much used by elephant and seladang, the deeply worn trails going down the river banks to the lick being sufficient testimony to the popularity of the lick.

But owing to a large influx of gold-stealing Chinese, and jelutong tappers, disturbance has done its deadly work to the larger fauna which frequented the valleys of the Telang and the Tengalan. This lick is no longer used as it was a few years ago.

In this area, that is to say between the Jelai River above Kuala Lipis, the Kuala Lipis—Raub Road, and the track from Raub to Kuala Medang, there is one old rhino which sometimes goes to

Jenut Blimbing. I believe that it is the sole survivor of the rhino in that area. I do not know its sex, but that is immaterial because rhinoceroses have not yet reached the Martian stage where they can propagate their species by budding-off. Rhino there, are doomed, because there is no hope of others coming into that terrain.

Conclusion.

That completes the list of important salt-licks in Ulu Pahang, but does not include those in the King George V National Park. I wish to state what I think should be done to save these licks from destruction.

Perhaps I should have given, earlier in this article, an explanation of the word 'Jenut'.

'Jenut' is the commonest word used by Malays in Pahang for salt-lick. A less common word is 'Taram'. The word 'Sesap' or 'Sesapan' is the word generally used in Negri Sembilan but is very occasionally used in Pahang.

None of the licks mentioned are in territory that has been opened up or developed; but Jenut Lanau, Jenut Stein and Jenut Tebarau are in country where there are Sakai.

The chief safe-guard for the preservation of these salt-licks must be by legal provision in the laws for the preservation of wildlife.

There is a ruling, agreed to by the Residents many years ago, that no land within two miles of a recognized salt-lick shall be given out until the Game Warden has been consulted on the matter. This ruling has not been invariably respected, and the present position is unsatisfactory.

In the Tersang Valley, in the Raub District, a buffalo farm was established almost on the top of Jenut Tersang, a valuable salt-lick used by seladang and elephants, and the only large lick in the neighbourhood. There was only one Jenut Tersang but dozens of places where a buffalo farm could have been established.

Some years ago a prospecting licence was given out without in any way consulting the Game Warden over an area embracing Jenut Misong and Jenut Batu.

Quite recently a prospecting licence was very nearly given out to cover an area embracing Jenut Lanau, the most important lick in the tributaries of the Jelai River.

These mistakes have been made due to slipshod record work in Land Offices, and can only be avoided or prevented by legislation.

An amendment to the law should be made to reserve from alienation, for any purpose whatsoever, except that of wildlife conservation, any land within a radius of two miles from all the active and valuable salt-licks, a list of which should be drawn up as a schedule to Wild Animals and Birds Protection Enactment. (Cap.: 193.).

Reservation of such areas should prohibit any action within such areas so reserved, which would cause disturbance to those

areas, and no permission should be given to any person to take any jungle produce or to undertake any prospecting of any kind within such areas.

Some of the licks I have mentioned are marked on the topographical map sheets, and the identification of their exact positions should be simple. Those not marked should be marked.

The following salt-licks in Ulu Pahang should be scheduled as coming within the scope of special legislation.

Jenut Lanau. Jenut Misong.	Telom Valley.
Jenut Bliong. Jenut Batu Dada. Jenut Batu Papan. Jenut Briang.	Serau Valley.
Jenut Stein. Jenut Gatak.	Jelai Ketchil Valley.
Jenut Blimbing.	... Telang Valley.

In other parts of Pahang there are salt-licks important to the welfare of the wildlife, and similar steps should be taken to guard them also.

It must be a part of any vigorous policy of Wildlife Conservation to preserve salt-licks, and if they are recognized, as they should be recognized, as important adjuncts to a congenial environment for many species, then laws to preserve them, and machinery to enforce those laws, become imperative.

THE GAME FISHES OF INDIA.[1]

BY

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(*With one plate and three text-figures*).

(*Continued from page* 319 *of Vol.* xlii, *No.* 2).

XIII. THE MAHSEERS OR THE LARGE-SCALED BARBELS OF INDIA.

6. THE JUNGHA OF THE ASSAMESE, *Barbus* (*Tor*) *progeneius* McClelland.

CONTENTS.

INTRODUCTION.

In one of the earlier articles of this series (**7**, pp. 78-79),[2] attention was directed to the species of Large-scaled Barbels described by McClelland from Assam and the hope was expressed that 'some specimens of *Jungha* from Assam would reach the author's hands by February, 1941, so as to enable him to deal with this species in a subsequent article.' Unfortunately the hope has remained unfulfilled, and I have so far not received any specimen authentically named as the *Jungha* of the Assamese. In consequence, I have to rely on what is already known concerning this species. The material in the collection of the Zoological Survey of India referred by me (**3**, pp. 328-330), to *Barbus* (*Tor*) *progeneius* is inadequate, and is not sufficient for the determination of the precise specific limits of the species. It is hoped that the members of the Society stationed in Assam will kindly send specimens of the true *Jungha* and other Mahseers of Assam, such as *Lobura, Burapetea* and *Bokar* to me in salt, formalin or spirits of wine.

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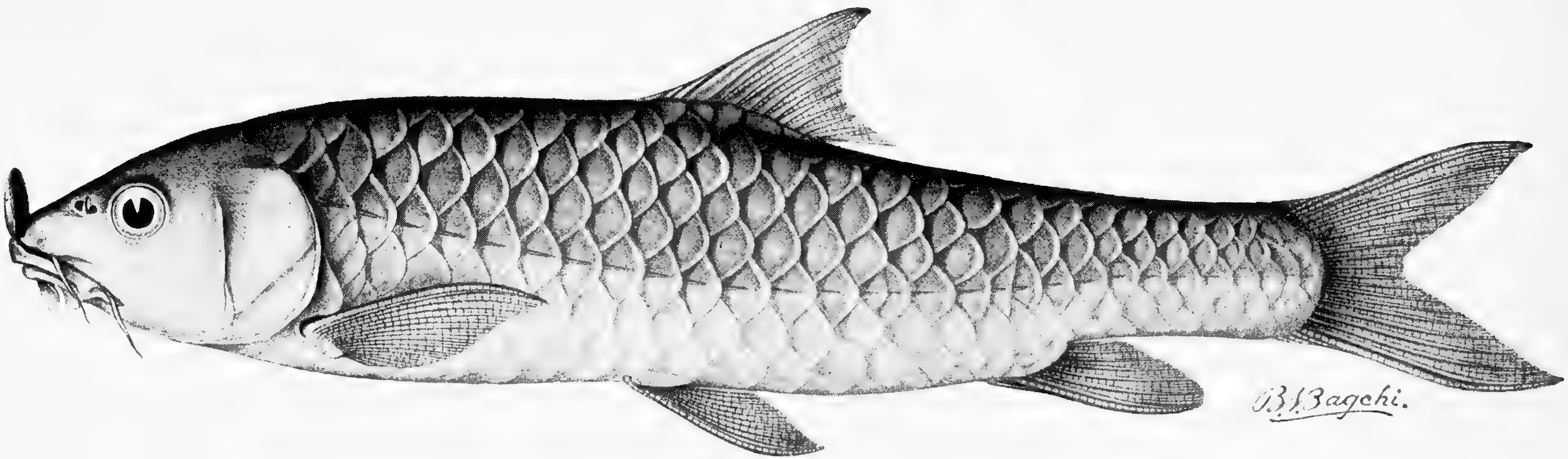
1 Published with permission of the Director, Zoological Survey of India.

2 Numerals in thick type within brackets refer to the serial numbers of the various publications listed in bibliography at the end of the paper.



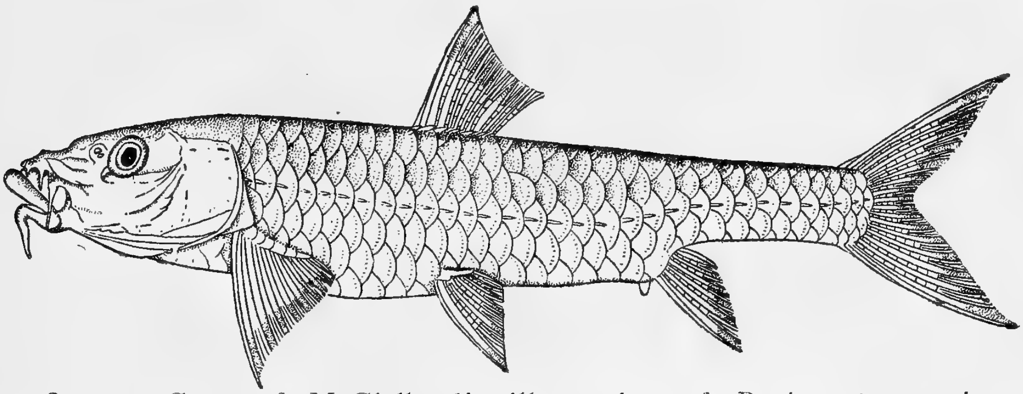
The *Jungha* of the Assamese.
BARBUS (TOR) PROGENEIUS McClelland.

History and Nomenclature.

In describing the *Jungha* under the name *Barbus progeneius*, McClelland (**8**, p. 270) observed in a foot-note that the name implies that the fish 'has a prominent chin or long beard; in allusion to the singular appendage to the lower jaw of this species by which it may be easily recognized.' It seems that McClelland was greatly influenced by this structure, for in the detailed description of the species on page 334, in referring to this character, he observed :

'. . . from the lower lip a fleshy appendix is extended, by which it is distinguished from the neighbouring species; nevertheless it is figured in Buchanan's collection of drawings as *Cyp. tor*, to which it bears so close an affinity that he may probably have considered it to be the same.'

If a comparison is made between Buchanan's figures of *Cyprinus tor* (**5**, p. 520, text-fig. 1) and that of McClelland's *B. progeneius*



Text-fig. 1.—Copy of McClelland's illustration of *Barbus progeneius* from Assam.

reproduced here, it will be evident that the two cannot represent the same species. In *tor* the head is more pointed and the body is considerably deeper and more pronounced along the ventral surface, while in *progeneius* the head is evenly pointed and is more or less equal to the depth of the body, which is slender and graceful. The presence of a labial fold in both the forms is not a very sound taxonomic character, as the development of this structure probably depends on certain, undetermined, environmental factors (**4**, pp. 279-282; **6**, p. 787). It is, however, a common feature of the true Mahseers, such as *B. putitora*, *B. tor* and *B. mosal*. *B. progeneius* in its general facies is similar to *B. mosal* and it is likely that when more material of the two forms becomes available they may prove to be identical. For the present and to elicit further information I propose to regard them as distinct species. More information would be welcome regarding the fan-shaped development above the upper lip in certain specimens of *progeneius*.

Günther (**2**, p. 130) used *B. mosal*, and Day (**1**, p. 564) used *B. tor* as a collective name for the various species of mahseers found in India; and no earlier worker appears to have recognised *B. progeneius* as a distinct species. In 1936, I (**3**, p. 328) regarded *B. progeneius* as a valid species, while *B. mosal* was considered a synonym of *B. putitora*.

SYNONYMY AND DESCRIPTION.

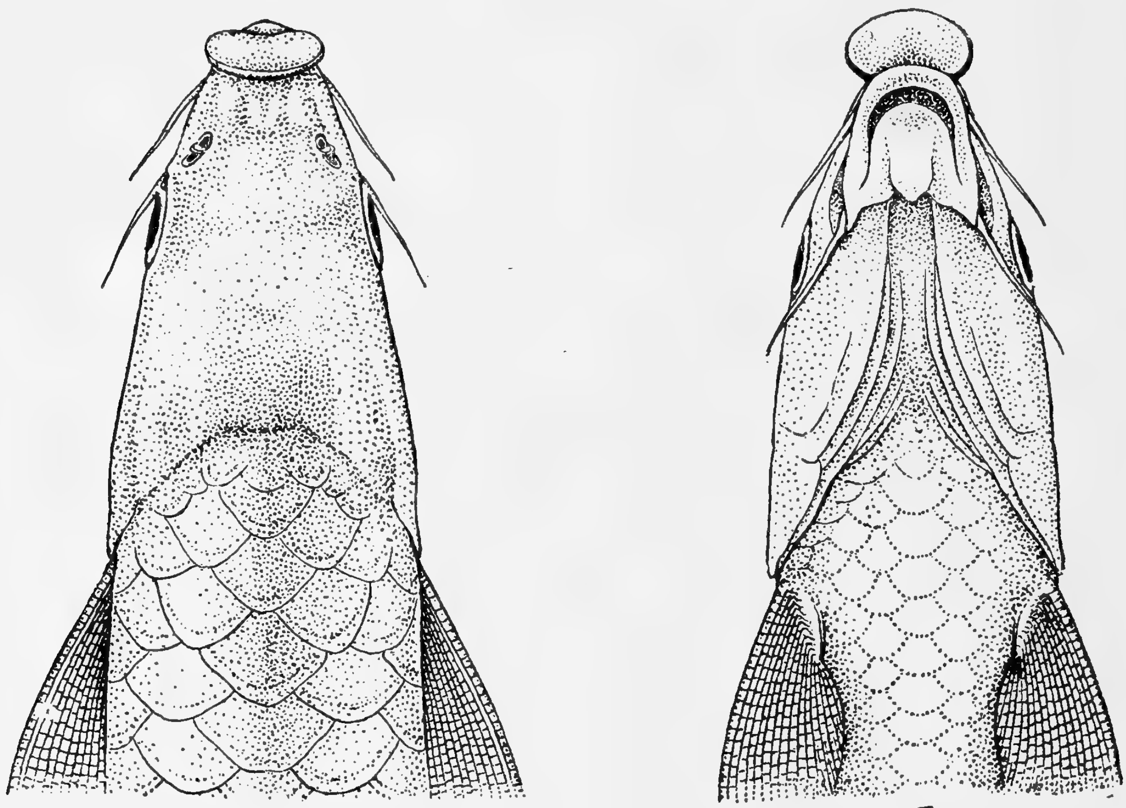
Barbus (Tor) progeneius McClelland.

1839. *Barbus progeneius* McClelland, *As. Res.*, XXIX, pp. 270, 334, pl. lvi, fig. 3.

1936. *Barbus progeneius* Hora, *Rec. Ind. Mus.*, XXXVIII, pp. 328-330, text-figs. 7-9.

D. 4/9; A. 3/5; P. 1/14; V. 2/8; C. 19.

Barbus progeneius is a graceful species in which, as in *B. mosal,* the head is almost as long as the depth of the body and the dorsal profile is somewhat more elevated than the ventral. The head is sharpish in front; its length is contained from 4.5 to 4.9 times in the total length and from 3.5 to 3.8 times in the standard length. The height of the head is contained from 1.3 to 1.5 times and its width from 1.6 to 2.2 times in its length. The head is relatively much narrower in smaller examples. The position of the eye varies

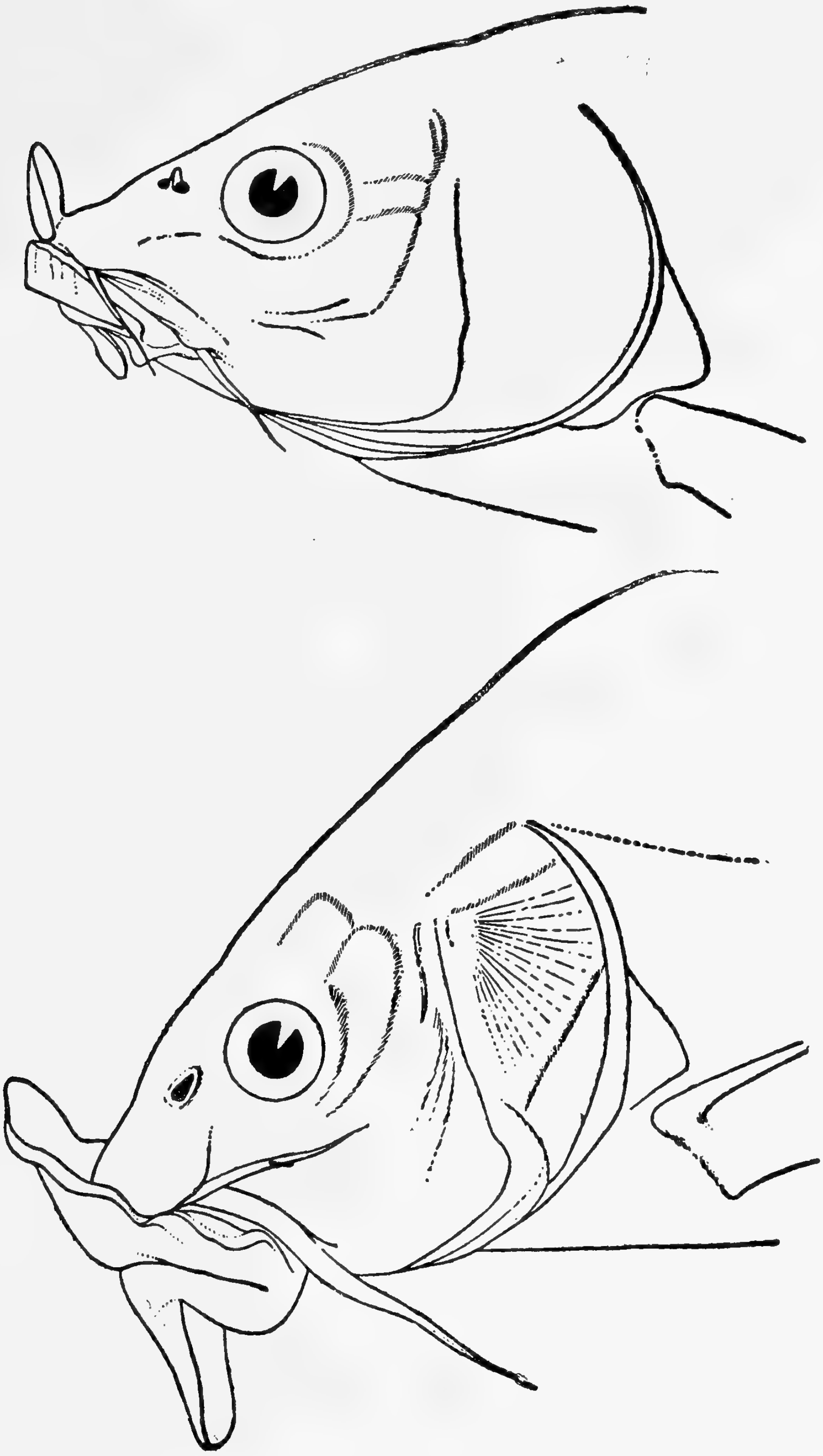


a. b.

Text-fig. 2.—Dorsal and ventral surfaces of head of the stuffed specimen of *Barbus* (*Tor*) *progeneius* McClelland. ×⅓.
a. Dorsal view; *b.* Ventral view.

with growth, but generally it is nearer to the tip of the snout than to the posterior border of the operculum. The eyes are moderately large; the diameter of the eye is contained in the length of the head from 3 times in the young to about 4.7 times in the adult. In the smaller individuals the length of the snout is almost equal to the diameter of the eye while in the adult it is about one and a half times. In the young the eyes are more approximated dorsally

and the interorbital space is less than the diameter of the eye while in the adult it is almost twice the eye-diameter. The depth



Text-fig. 3.—Lateral view of head and anterior part of body of *Barbus* (*Tor*) *tor* (Ham.) and *B.* (*Tor*) *progeneius* McClelland showing the nature of the hypertrophied upper and lower lips.

Upper figure: *Barbus* (*Tor*) *progeneius* McClelland. ×2/5.

Lower figure: *Barbus* (*Tor*) *tor* (Hamilton). ×3/5.

These illustrations are reproduced from the *Records of the Indian Museum* (vol. xxxviii, pp. 327, 329, 1936) by the courtesy of the Director, Zoological Survey of India.

of the body is more or less equal to the length of the head and the least height of the caudal peduncle is contained from 1.4 to 1.8 times in its length.

The mouth is of moderate size; its gape does not extend to below the eyes and is somewhat obliquely directed upwards. The lips are fleshy and continuous at the angles of the mouth; the labial groove is present. The posterior lip may or may not be produced backwards as a median lobe, but generally a well-developed median lobe is present. Behind the upper lip there is a rounded, fan-shaped structure which in form and extent is quite different from the hypertrophied lips in *Barbus putitora* (**4**, pl. ii, fig. 3) and *B. tor* (**5**, pl. ii, fig. 1; pl. iii). I have not seen any specimen of *B. mosal* with a similar structure, and for this reason I am retaining *B. progeneius* as a separate species. The fan-shaped structure is 32.5 mm. broad and 22.0 mm. long in a specimen 690 mm. in total length. As such a structure has not been observed in any other specimen so far, it may prove to be an abnormal condition.

The rostral and the maxillary barbels may be equal in length, but generally the latter are somewhat longer. The scales are large and well formed; there are 24 to 27 scales along the lateral line, and $2\frac{1}{2}$ rows between the lateral line and the base of the pelvic fin. There is a well-developed scaly appendage in the axil of each pelvic fin.

The dorsal fin commences opposite to or slightly in advance of the pelvics; its origin is midway between the tip of the snout and the base of the caudal fin or somewhat nearer to the former. The dorsal spine is rather weak; the longest ray of the dorsal fin is equal to the depth of the body in young specimens, but in the adult specimens it is considerably shorter. The pectoral fins are lanceolate and are placed low down on the body; they are considerably shorter than the length of the head. The pelvics are similar to the pectorals and are separated from the anal by a considerable distance. The anal fin is somewhat longer than the pelvics and slightly rounded near the tip. The caudal fin is deeply forked with both the lobes pointed.

In specimens preserved in spirit, the surface above the lateral line is grayish, becoming deeper towards the dorsal side, while the lower parts of the head and body are silvery. The bases of the scales are provided with dark blotches which are more prominent along the dorsal surface.

Bionomics and Distribution.—McClelland (**8**, p. 330) observed that 'The intestines are capacious, and consist of four convolutions extending along the posterior half of the abdominal cavity, leaving the anterior portion of that cavity chiefly to the stomach and liver. The first is a conical sac (larger than the stomach of the Cirrhins) occupying the right side, and terminating simply in the intestine. The liver is broad consisting of several lobes, chiefly placed on the left side of the stomach.'

B. progeneius was described from Assam, and I (**3**, p. 328) have referred a number of specimens from the Naga Hills, Assam, to this species. If it proves to be a synonym of *B. mosal* then the fish will have a much wider range of distribution.

MEASUREMENTS IN MILLIMETRES.

	Barak River. (Stuffed specimen)	Irang River, Naga Hills			
Total length	690·0	203·5	198·5	108·0	102·0
Standard length ...	540·0	150·0	155·0	85·0	78·5
Length of head ...	141·0	42·5	43·0	24·0	22·5
Height of head ...	109·0	29·0	29·5	17·0	14·5
Width of head ...	85·0	23·5	28·0	12·0	10·0
Diameter of eye ...	30·0	11·0	12·0	7·8	7·5
Length of snout ..	46·0	13·0	14·0	7·5	7·5
Interorbital distance ...	55·5	14·0	14·0	7·0	6·5
Depth of body	138·0	41·0	43·0	23·0	22·0
Width of body	81·0	21·5	21·5	11·5	9·5
Length of caudal peduncle	102·0	29·0	30·5	15·2	14·5
Least height of caudal peduncle	61·0	16·5	17·5	11·0	9·5
Length of dorsal fin ...	101·0	36·0	33·0	21·5	22·0
Length of pectoral fin ...	108·0	34·5	34·5	18·5	17·5
Length of pelvic fin ...	88·0	27·5	26·5	15·5	14·0
Length of anal fin ...	95·0	32·0	30·0	17·0	15·5

Acknowledgments.

As in the case of the previous articles, the Bombay Natural History Society has very generously borne the entire cost of illustrating this article, and for this my best thanks are due to the authorities of the Society. I am indebted to Mr. K. S. Misra for preparing the table of measurements and to Babu B. N. Bagchi for preparing the illustrations under my supervision.

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Explanation of Plate.

Lateral view of a stuffed specimen of *Barbus* (*Tor*) *progeneius* McClelland from the Barak River on the Imphal-Silchar Road, Naga Hills, Assam. × *ca* $\frac{1}{4}$. The specimen is now exhibited in the Fish Gallery of the Indian Museum, Calcutta.

A CONTRIBUTION TO THE FLORA OF THE PUNJAB PLAINS AND THE ASSOCIATED HILL REGIONS

BY

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PART III.

(Continued from page 379 of this volume).

[1] LXIX. SALVADORACEAE.

283. SALVADORA *L.*

523. **Salvadora oleoides** Dcne. in Jacquem. Voy. Bot. 140, t. 144.

Locality.—Hissar (Duthie 4191 !).
Flowers.—August.
Distribution.—Aden. India—the Punjab, Rajputana and Sind plains, frequent.

LXX. APOCYNACEAE.

284. CARISSA *L.*

524. **Carissa spinarum** A.DC. Prodr. VIII, 332.

Locality.—Hoshiarpur (* Ait. 286 !); Rawalpindi (Ait. 463 !).
Fruits.—April.
* With **Cuscuta reflexa** as a parasite.
Distribution.—Drier parts of India. Burma; Ceylon.

525. **Carissa grandiflora** A.DC. Prodr. VIII, 335.

Locality.—Lahore—Ag. Hort. Gdns. (Mustoe 6373 !).
Distribution.—S. Africa.

285. RHAZYA *DCNE.*

526. **Rhazya stricta** Decaisne in Ann. Nat. Sc. Ser. 2, IV, 81 and in Jacquem Voy. Bot. t. 111.

Locality.—Rawalpindi-Attock (Ait. 1076 !).
Flowers.—March.
Distribution.—Afghanistan, Baluchistan, Arabia. India—Sind, Peshawar, in the Trans-Indian territory common.

286. HOLARRHENA *Br.*

527. **Holarrhena antidysenterica** Wall. Cat. 1672.

Locality.—Gurdaspur-Dhunera (Bisram 309 !).
Distribution.—Throughout the drier forests of India, tropical Himalaya ascending to 3,500 ft., Malacca.

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[1] When numbering the orders the figure XIII was omitted in the first part, hence all order numbers are one ahead of the correct sequence. This has been rectified in this part. The number of orders is thus 117, not 118 as stated (p. 124).

287. WRIGHTIA *Br.*

528. **Wrightia tinctoria** Br. in Mem. Wern. Soc. I, 73.

Vernacular name.—*Inderjow.*
Locality.—Gurgaon (Holland 54325 !).
Fruits.—January.
Distribution.—Burma, Timor. Central India and throughout the Western Peninsula.

529. **Wrightia tomentosa** Roem. & Schultes Syst. IV, 414.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13617 !).
Flowers.—May.
Distribution.—Tropical India ascending to 2,000 ft. in the Himalaya and to 4,000 ft. in the Nilgiris. Burma; Ceylon; Penang.

288. NERIUM *L.*

530. **Nerium odorum** Soland. in Hort. Kew. ed., V, 1, 297.

Locality.—Rawalpindi (Ait. 464 !).
Flowers.—April.
Distribution.—Nepal; Afghanistan; Japan. India—Sind, Central India, W. Himalaya, ascenidng to 6,500 ft. in Murree.

289. TRACHELOSPERMUM *LEMAIRE.*

531. **Tracheiospermum fragrans** Hk. f.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 14353 !).
Flowers.—April.
Distribution.—India—temperate and subtropical Himalaya.

532. **Trachelospermum jasminoides** Lem. Jard. Fleur. I (1851) t. 61.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 14352 !).
Flowers.—April.
Distribution.—China.

290. ICHNOCARPUS *Br.*

533. **Ichnocarpus frutescens** Br. in Hort. Kew. ed., ii, 60.

Locality.—Gurdaspur (496 !, 497 ! Drum's Herb.); Hoshiarpur (Ait. 501 !), Lahore—Ag. Hort. Gdns. (Parker 14248 !, 7017 !).
Flowers.—September.
Distribution.—Java; Australia; Ceylon. Throughout India, ascending to 1-2,000 ft. in W. Himalaya.

LXXI. ASCLEPIADACEAE.

291. CRYPTOLEPIS *Br.*

534. **Cryptolepis Buchanani** Roem. & Schult. Syst. IV, 409.

Locality.—Rawalpindi-Chaka 3,500 ft. (Jerram 7353 !).
Fruits.—February.
Distribution.—Throughout India, ascending Himalaya to 4,000 ft. Ceylon.

292. PERIPLOCA *L.*

535. **Periploca aphylla** Dcne. in Jacq. Voy. Bot. 109, t. 116.

Locality.—Rawalpindi-Kahuta (Parker 6500 !); Kala chitta (Parker 6499 !).
Flowers.—March. *Fruits.*—December.

Distribution.—Afghanistan; Persia; Arabia; Nubia. India—Sind, Rajputana, Plains of W. Punjab.

293. OXYSTELMA *Br.*

536. **Oxystelma esculentum** Br.

Vernacular name.—Makkanvel.
Locality.—Lahore—islands in the Ravi near Chung (Parker 13781!, 13779!, 13780!).
Flowers.—September.
Distribution.—Ceylon; Java; Ava.—Throughout the plains and lower hills of India.

294. CALOTROPIS *Br.*

537. **Calotropis procera** Br. in Ait. Hort. Kew. ed. 2, II, 78.

Locality.—Peshawar College (Quizilbash 64!); Changa Manga (Kanjilal!).
Flowers.—January.
Distribution.—Ava; Persia; tropical Africa. India—W. and C. parts, Sind, Rajputana.

295. PENTATROPIS *Br.*

538. **Pentatropis spiralis** Dcne. in Ann. Sc. Nat. 1838, 327, t. 11 E. and in DC. Prodr. VIII, 536.

Locality.—Lahore—Ag. Hort. Gdns. (*Parker 6832!); Changa Manga (Kanjilal 107!); Kot Lakhpat (Parker 14883!); Hissar (Duthie 4204!).
Flowers.—February.
* Wild in Ag. Hort. Gdns. and growing over *Salvadora.*
Distribution.—Afghanistan and westwards to the Red Sea and Nubia. India—the Punjab, Sind and eastwards to the Jummna river.

296. DAEMIA *Br.*

539. **Daemia extensa** Br. in Mem. Wern. Soc. I, 50.

Locality.—Hoshiarpur (Ait. 439!); Hissar (Duthie 5233!, 4194!); Lahore—Changa Manga (Parker 6846!; Kanjilal!).
Flowers.—August-April.
Distribution.—Ceylon; Afghanistan. Throughout India, ascending N.-W. Himalaya to 3,000 ft.

297. HOLOSTEMMA *Br.*

540. **Holostemma Rheedii** Wall. Pl. As. Rar II, 51 & Cat. 4469.

Locality.—Rawalpindi—Falconer's Herb.
Flowers.—August.
Distribution.—Pegu; Burma; India tropical Himalaya, alt. 3-5,000 ft., Deccan Peninsula.

298. PERGULARIA *L.*

541. **Pergularia pallida** Wight & Arn. Contrib. 42.

Locality.—Rawalpindi (Ait. 466!).
Flowers.—July-August.
Distribution.—Throughout India. Burma, Ceylon.

299. LEPTADENIA *Br.*

542. Leptadenia Spartium Wight Contrib., 48.

Locality.—Jhind State (Raitt 23972 !, 23973 !); Multan (Duthie 10789 !, Monro 39 !); Hoshiarpur (Holland 7017 !).
Flowers.—September-February.
Distribution.—Baluchistan; Arabia; Egypt; Senegambia. India—the Punjab, Sind, Rajputana, eastwards to Jummna.

300. CEROPEGIA *L.*

543. Ceropegia bulbosa Roxb. Car. Pl. I, 11, t. 7.

Locality.—Hissar (Coldstream).
Flowers.—July.
Distribution.—Western India, the Punjab and Upper Gangetic plain, southwards to Travancore.

LXXII. LOGANIACEAE.

301. BUDDLEIA *L.*

544. Buddleia asiatica Lour. Fl. Cochinch., 72.

Locality.—Rawalpindi—Sangeri 5,000 ft. (Jerram 7534 !, 7533 !); (Ait. 491 !); Gurdaspur—Siyapurkandi (Bisram 841 !).
Flowers.—March-May.
Distribution.—Malay; Cochin-China; China. Throughout India, ascending to 6,000 ft., very common.

545. Buddleia madagascariensis Lamk. Encyc. I, 513.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 12948 !); Hoshiarpur. (*Ait. 547).
Flowers.—April.
Distribution.—Madagascar. *Cultivated.

546. Buddleia Lindleyana Fortune in Lindl. Bot. Reg. (1844) Misc. 25.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 12949 !).
Flowers.—April.
Distribution.—China.

LXXIII. GENTIANACEAE.

302. ENICOSTEMA *BLUME.*

547. Enicostema littorale Blume Bijd. 848.

Locality.—Multan (Monro 69 !).
Distribution.—Malaya; Trop. Africa; W. Indies. Throughout India, alt. 0-1,500 ft.

303. ERYTHRAEA *L. C. RICH.*

548. Erythraea ramosissima Pers. Syn. I, 283.

Locality.—Peshawar College (Quizibash 16 !).
Distribution.—Kabul; Baluchistan; W. Asia; Egypt. India—the Punjab, alt. 1-2,000 ft.

549. Erythraea Roxburghii G. Don. Gen. Syst. IV, 206.

Locality.—Rawalpindi (Ait. 468 !); Lahore (Stewart 2623 !).
Flowers.—May.
Distribution.—Throughout India, ascending to 2,000 ft., common in Bengal plains.

304. GENTIANA *L.*

550. **Gentiana decemfida** Ham. Don Prodr. 127.

Locality.—Hoshiarpur (Ait. 531 !).
Distribution.—India—the Punjab, N.-W. and C. Himalaya, alt. 1-8,00 ft.

LXXIV. BORAGINACEAE.

305. CORDIA *L.*

551. **Cordia obliqua** Willd. Sp. Pl. I, 1072.

Locality.—Rawalpindi (Ait. 473 !).
Flowers.—May.
Distribution.—W. India and the Punjab, frequent. Ceylon; Nicobar. Cultivated.

552. **Cordia Rothii** Roem. & Schult. Syst. IV, 798.

Locality.—Multan (Monro 382 !).
Flowers.—April.
Distribution.—Arabia; Abyssinia. W. India, from the Punjab, Hardwar, Rajputana, Sind, to Malabar, frequent.

306. EHRETIA *L.*

553. **Ehretia acuminata** Br. Prodr. 497.

Locality.—Gurdaspur (Fane 4855 !); Hoshiarpur (Ait. 598 !).
Flowers.—June.
Distribution.—Ava; Australia; Japan. India—subtropical Himalaya, ascending to 5,000 ft. and adjacent plains, common.

554. **Ehretia laevis** Roxb. Cor. Pl. 42, t. 55 and Fl. Ind. ed. Carey & Wall. II, 341.

Locality.—Hoshiarpur (Ait. 468 !).
Distribution.—Persia to China; Australia and Polynesia. Throughout India, in tropical and subtropical regions, common.

555. **Ehretia laevis** Roxb. var. *pubescens.*

Locality.—Hoshiarpur (Ait. 172 !).
Distribution.—Throughout India.

556. **Ehretia laevis** Roxb. var. *aspera.*

Locality.—Lahore—Changa Manga (Parker 14355 !, 14357 !).
Flowers.—October.
On irrigated canal best. A shrub 8-10 ft. high.
Distribution.—India.

557. **Ehretia obtusifolia** Hochst.

Locality.—Rawalpindi (Ait. 84 !); Lahore—Changa Manga !.
Distribution.—Abyssinia. India—Sind, the Punjab. Baluchistan.

558. **Ehretia buxifolia** Roxb. Cor. Pl. I, 42, t. 57 and in Fl. Ind. ed. Carey and Wall. II, 343.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 38696 !).
Flowers.—May.
Distribution.—Malaya to Formosa and the Philippines. India—Deccan Peninsula.

307. Heliotropium *L.*

559. **Heliotropium Eichwaldi** Steud; DC. Prodr. IX, 535.

Locality.—Rawalpindi (Ait. 470 !); Lahore (Stewart 2606 !).
Flowers.—April-May.
Distribution.—Central Asia; Australia. India—the Punjab, Sind, Rajputana, in the plains frequent, Kashmir, alt. 5,200 ft.

560. **Heliotropium undulatum** Vahl Symb. I, 13.

Locality.—Lahore (2956 ! Brandis Herb.; Stewart 2583 !, 2592 !); Rawalpindi (Ait. 472 !).
Flowers.—March.
Distribution.—W. Asia; N. Africa. India—the Punjab, Sind, Rajputana, Upper Gangetic plains, alt. 0-1,000 ft., frequent.

561. **Heliotropium paniculatum** Br. Prodr. 494, not of Roxb.

Locality.—Hissar (Harsukh 20690 !).
Flowers.—October.
Distribution.—Ceylon; Siam; Australia. India—Rajputana, Sind, S. Deccan.

562. **Heliotropiums strigosum** Willd. Sp. Pl. I, 743.

Locality.—Rawalpindi (Ait. 471 !); Hissar (Duthie 4219 a).
Flowers—May-August.
Distribution.—W. Asia; Malaya; Australia. Throughout India, very common.

563. **Heliotropium strigosum** Wild. var. *brevifolia.*

Locality.—Lahore (2983 ! Brandis Herb.; Stewart 2809 !, 2584 !, 2506 !, 2810 !, Cleghorn 2642 !).
Flowers—March-April.
Distribution.—Throughout India, even more abundant than *H. strigosum* type.

308. Trichodesma *Br.*

564. **Trichodesma indicum** Br. Prodr. 496.

Locality.—Rawalpindi—Barrakow (Ait. 479 !); Gurdaspur—Siyapurkandi (Bisram 842 !).
Flowers—April-May.
Distribution.—Kabul; Baluchistan; Persia; Mauritius. Throughout India, common; not in Bengal plain.

309. Cynoglossum *L.*

565. **Cynoglossum furcatum** Wall. in Roxb. Fl. Ind. ed. Carey & Wall II, 6 and Cat. 919.

Locality.—Rawalpindi (Ait. 53 !).
Flowers.—September.
Distribution.—Ceylon; Kabul. Throughout India.

566. **Cynoglossum micranthum** Desf. Cat. Hort. Par. 1804, 220, fide A. DC. Prodr. X, 149.

Locality.—Lahore (Stewart 2808 !).
Flowers.—April.
Distribution.—N. India and the Himalaya, alt. 1-8,000 ft.

310. Echinospermum *SWARK.*

567. **Echinospermum minimum** Lehm. Asperifol. 126.

Locality.—Rawalpindi—Hurror (Ait. 1085 !).
Flowers.—March.

Distribution.—Kabul; Baluchistan to the Ural Mts. and Altai. India—Punjab, Kashmir, temperate regions.

311. Rochelia *REICHB.*

568. **Rochelia stylaris** Boiss. Fl. Orient. IV, 245.

Locality.—Rawalpindi (Ait. 475 !).
Flowers.—March.
Distribution.—Kabul. India—Kashmir and adjoining Punjab Plains.

312. Aspergo *L.*

569. **Aspergo procumbens.** L.

Locality.—Rawalpindi—Fattehganj (Ait. 1084 !).
Flowers.—March.
Distribution.—Europe; N. Africa; W. C. and N. Asia. India—Punjab and Kashmir, alt. 1-7,000 ft.

313. Gastrocotyle *BUNGE.*

570. **Gastrocotyle hispida** Bunge Rel. Rehm. 405.

Locality.—Rawalpindi (Ait. 1080 !).
Flowers.—March.
Distribution.—Egypt to Baluchistan; Kabul and Soongaria. India—Punjab, alt. 1,000 ft.

314. Nonnea *MOENCH.*

571. **Nonnea pulla** Lamk. et. DC. Fl. Fr. III, 626.

Locality.—Rawalpindi (Ait. 1082 !, 477 !); Lahore (Stewart 2530 !, 2579 !, 2811 !).
Flowers.—April.
Distribution.—C. and E. Europe; W. Asia. India—Punjab Plains.

315. Lithospermum *L.*

572. **Lithospermum arvense** L. DC. Prodr. X, 74.

Locality.—Rawalpindi (Ait. 474 !); Peshawar (Stewart 75 !).
Flowers.—March.
Distribution.—Kabul, Siberia to N. Africa, Europe. India.

573. **Lithospermum tenuifolium** L.f. Suppl. 130.

Locality.—Peshawar (Quizilbash 37 !).
Distribution.—Kabul, W. Asia to Egypt and Greece. India.

316. Arnebia *FORSK.*

574. **Araebia hispidissima** DC. Prodr. X, 94.

Locality.—Lahore (Stewart 2571 !, 2572 !); Rawalpindi (Ait. 476 !).
Flowers.—March.
Distribution.—W. Asia to Egypt and Nubia. India—W. India, alt. 500-3,000 ft., Sind, from the Upper Gangetic plains and Rajputana westwards frequent.

575. **Arnebia Griffithii** Boiss. Fl. Orient IV, 213.

Locality.—Rawalpindi—Hurror (Ait. 1081 !).
Flowers.—March.
Distribution.—Baluchistan; Kabul. India—Punjab, Sind.

LXXV. CONVOLVULACEAE.

317. Rivea *CHOIS.*

576. **Rivea hypocrateriformis** Chois. Convol. Or. 26 and in DC. Prodr. 326.

Locality.—Hissar (Duthie 4232 !).
Flowers.—August.
Distribution.—W. India, in dry forests from Lahore and Bihar to Mysore, common.

318. Argyreia *LOUR.*

577. **Argyreia speciosa** Sweet Hort. Brit. ed. 2, 373.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13791 !).
Flowers.—September.
Distribution.—Java, also from China; Mauritius; cultivated. India, alt. 0-1,000 ft.

578. **Argyreia splendens** Sweet Hort. Brit. ed. 2, 373.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 15034 !, 15033 !).
Flowers.—November.
Distribution.—India—Kashmir mountains.

319. Ipomoea *L.*

579. **Ipomoea Quamoclit** L. Bot. Mag. t. 244.

Locality.—Hoisharpur (Ait. 635 !).
Distribution.—Common throughout India, in gardens and as a denizen. Native of Tropical America.

580. **Ipomoea hederacea** Jacq. Collect. I, 124 and Ic. Rar. I, t. 36.

Locality.—Rawalpindi—Saidpur (Ait. 208 !).
Flowers.—September.
Distribution.—Tropical and subtropical regions of both hemispheres. India both cultivated and apparently wild, common.

581. **Ipomoea eriocarpa** Br. Prodr. 484.

Locality.—Rawalpindi (Ait. 207 !).
Flowers.—September.
Distribution.—Ceylon; Afghanistan, and Tropics of the Old World. Throughout India, alt. 0-4,000 ft., common.

582. **Ipomoea bonariensis** Hook. Bot. Mag. t. 3665.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 14245 !, 14246 !).
Flowers.—September.
Distribution.—Argentine.

583. **Ipomoea Learii** Paxt. Mag. Bot. VI (1839) 267.

Locality.—Lahore—Ag. Hort. Gdns. (Mustoe 6372 !).
Flowers.—June.
A Garden Plant.
Distribution.—Tropical America.

584. **Ipomoea carnea** Jacq. Enum. Pl. Carib. 13.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13727 !, 11448 !).
Flowers.—May. *Fruits.*—February.
A Garden Plant.
Distribution.—S. America.

320. CONVOLVULUS *L.*

585. **Convolvulus microphyllus** Sieb.; Vis. Pl. Aeg—Nub. 12.

Locality.—Montgomery (Parker 13134 !); Multan (Monro 30 !, 349 !, 362 !).
Flowers—March-October.
Distribution.—Baluchistan to Egypt and Nubia. India—Sind, Rajputana.

586. **Convolvulus pluricaulis** Chois. Convol. Or. 95 and in DC. Prodr. IX 403 (the Plains plant).

Locality.—Lahore (Stewart 2510 !, 2531 !).
Flowers.—March.
Distribution.—India—Sind and plains of Hindustan and Bihar.

587. **Convolvulus pluricaulis** Choiss. *var.—macra.*

Locality.—Rawalpindi (Ait. 481 !).
Flowers.—April.
Distribution.—India—Punjab, common, from 3,000 ft. alt. in Kashmir to Delhi.

588. **Convolvulus arvensis** L. Engl. Bot. t. 312.

Locality.—Rawalpindi (Ait. 480 !); Lahore (3011 !).
Flowers.—April.
Distribution.—Nearly all temperate and subtropical regions. India—Sind, W. India, from Kashmir to the Deccan, a weed of cultivation.

321. EVOLVULUS *L.*

589. **Evolvulus alsinoides** L.

Locality.—Rawalpindi (Ait. 161 !).
Flowers.—August.
Distribution.—Ceylon, very common; the tropical and subtropical area of the globe; rare in very damp regions. Throughout India, very common.

322. PORANA *BURM.*

590. **Porana paniculata** Roxb. Cor. Pl. III, 31, t. 235 and Fl. Ind. I, 466 and ed. Carey & Wall. II, 39.

Locality.—Pathankote (Ellis !); Hoshiarpur (Ait. 515 !).
Flowers.—December.
Distribution.—Ceylon; Ava; Java. Throughout India, less common in the South Deccan.

323. CUSCUTA *L.*

591. **Cuscuta reflexa** Roxb. Cor., Pl. II, 3, t. 104 and Fl. Ind. I, 466 and ed. Carey & Wall. I, 466.

Locality.—Rawalpindi (* Ait. 563 !).
Flowers.—December.
* On *Carissa diffusa, Zizyphus vulgaris, Acacia robusta. Acacia arabica, Inga dulcis, Linum usitatissimum, Duranta* sp., *Jasminum* sp.
Distribution.—Ceylon; Malaya. Throughout India, alt. 0-8,000 ft., Bengal plains abundant.

LXXVI. SOLANACEAE.

324. SOLANUM *L.*

592. **Solanum nigrum** L.

Locality.—Rawalpindi (Ait. 583 !); Lahore (Stewart 2541 !).
Flowers.—October.

Distribution.—All temperate and tropical parts of the world. Throughout India and Ceylon, alt. 0-7,000 ft., common.

593. **Solanum verbascifolium**

Locality.—Hoshiarpur (Ait. 508 !).
Distribution.—S.-E. Asia; Malaya; N. Australia; Tropical Africa. Throughout India, in the tropical and subtropical zone, common.

594. **Solanum torvum** Swartz Prodr. Veg. Ind. Occ. 47.

Locality.—Lahore—Changa Manga (Parker 24329 !, 24973 !, 24974 !, 13728 !).
Flowers.—May-December.
Distribution.—Malaya; China; Philippines; Tropical America. Throughout India in the tropical region except the western desert area, very common in Bengal.

595. **Solanum coagulans** Forsk. Fl. Aeg. Arab. 47.

Locality.—Rawalpindi (* Ait. 212 !).
Flowers.—September.
* Everywhere.
Distribution.—S.-W. Asia; Arabia; Egypt. India—W. India, Punjab, Sind.

596. **Solanum xanthocarpum** Schrad. & Wendl. Sert. Hanov. I, 8, t. 2.

Locality.—Rawalpindi (Ait. 482 !); Lahore (Cleghorn 2648 !).
Flowers.—April.
Distribution.—S.-E. Asia; Malaya; Tropical Australia and Polynesia. Throughout India, common.

597. **Solanum gracilipes** Dcne. in Jacquem. Voy. Bot. 113, t. 110.

Locality.—Rawalpindi (Ait. 482 !).
Flowers.—March.
Distribution.—Baluchistan. India—W. India, Punjab and Sind.

598. **Solanum hispidum** Pers. Syn. I, 228.

Locality.—Lahore—Ag. Hort. Gdns. (* Parker 21224 !).
Fruits.—Globose.
* Cultivated.
Distribution.—Peru.

599. **Solanum macranthum** Dun.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 38694 !).
Flowers.—April.
Distribution.—Brazil.

600. **Solanum Rantonnetii** Carr.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13610 !).
Flowers.—July.
Distribution.—Argentine.

601. **Solanum malacoxylon** Sendt. in Mart. Fl. Bras. X, 52.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 15029 !).
Flowers.—July.
Native of Brazil.
Distribution.—Argentine.

325. Lycopersicum *MILLER.*

602. **Lycopersicum esculentum** Miller.

Locality.—Rawalpindi (Ait. 483 !).
Flowers.—May.
Distribution.—India, cultivated and as an escape. Native of Tropical America.

326. Withania *PAUQ.*

603. **Withania somnifera** Dunal. in DC. Prodr. XIII, Pt. I, 453.

Locality.—Lahore—Changa Manga (Parker 7726 !); Lahore (Stewart 2823 !, 2626 !); Rawalpindi (Ait. 484 !); Peshawar College (Quizilbash 19 !).
Flowers.—March-December.
Distribution.—Mediterranean region, with the Canaries; Cape of Good Hope. Throughout drier subtropical India, frequent in the west and Hindustan, rare in lower Bengal.

327. Lycium *L.*

604. **Lycium europaeum** L.

Locality.—Hissar (Harsukh 20681 !).
Flowers.—October.
Distribution.—Mediterranean region; W. Asia. W. India, alt. 0-5,000 ft., frequent.

328. Datura *L.*

605. **Datura Stramonium** L.

Locality.—Rawalpindi (Ait. 210 !).
Flowers.—September.
Distribution.—Nearly throughout the globe, in temperate and warm climate. India—temperate Himalaya.

606. **Datura fastuosa** L. var. *alba.*

Locality.—Lahore—Changa Manga (Parker 24817 !, 20146 !, 24269 !, 24270 !; Stewart 2512 !).
Flowers.—December.
Has increased during the last few years in unirrigated places.
Distribution.—Malaya; Tropical Africa. Throughout India, in waste places, a weed.

607. **Datura Metel** L.

Locality.—Lahore—Changa Manga (Parker 20143 !, 20144 !, 20145 !, 20139 !, 20140 !, 20141 !, 20142 !).
Flowers.—August.
Distribution.—Tropical America, widely naturalised in the Old World. India—W. Himalaya and Mts. of W. Deccan Peninsula, introduced.

329. Hyoscyamus *L.*

608. **Hyoscyamus muticus** L. Mant. 45.

Locality.—Lahore (Stewart 2614 !).
Flowers.—April.
Dsitribution.—Kabul, westwards to Egypt. India.—W. Punjab, Sind.

330. Cestrum *L.*

609. **Cestrum nocturnum** L. Sp. Pl. 191.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 11409 !, 12967 !).
Flowers.—February-April.
8 ft. high.
Distribution.—S. America.

LXXVII. SCROPHULARIACEAE.

331. VERBASCUM L.

610. **Verbascum Thapsus** L.

Locality.—Rawalpindi (Ait. 485 !).
Flowers.—April.
Distribution.—India—Temperate Himalaya. Westwards to Britain.

332. CELSIA L.

611. **Celsia coromandeliana** Vahl Symb. III, 79.

Locality.—Hoshiarpur (Ait. 50 !); Rawalpindi (Ait. 85 !, 487 !, 486 !); Lahore (Stewart 2802 !, 2568 !).
Flowers.—March-July.
Distribution.—Afghanistan; Ava; China. Throughout India.

333. LINARIA L.

612. **Linaria ramosissima** Wall. Pl. As. Rar. II, 43, t. 153 and Cat. 3911.

Locality.—Rawalpindi (Ait. 213 !); Peshawar College (Quizilbash 50 !).
Flowers.—September.
Distribution.—Afghanistan; Ava. Throughout India on rocks and stony places, ascending the hills to 5,000 ft.

613. **Linaria minor** Desf.; Benth. in DC. Prodr. X, 287.

Locality.—Rawalpindi—Hussand and Tilla (Ait. 1089 !).
Flowers.—March.
Distribution.—India—the Punjab plains. Westwards to Britain.

334. ANTIRRHINUM L.

614. **Antirrhinum Orontium** L. Benth. in DC. Prodr. X, 290.

Locality.—Rawalpindi, Barrakow (Ait. 485 !); Hurrod (1088 !).
Flowers.—March-April.
Distribution.—India—the Punjab plains and W. Himalaya ascending to 4,000 ft., an escape in the Nilgiris. Westwards to N. Africa and Britain.

335. SCROPHULARIA L.

615. **Scrophularia scabiosaefolia** Benth. in DC. Prodr. X, 313.

Locality.—Rawalpindi (Ait. 489 !).
Flowers.—March.
Distribution.—W. Tibet 10-12,000 ft.; Afghanistan. India—Peshawar hills, W. Himalaya, alt. 10-1,200 ft.

336. MIMULUS L.

616. **Mimulus gracilis** Br. Prodr. 439.

Locality.—Peshawar College (Quizilbash 2 !); Rawalpindi (Ait. 490 !).
Flowers.—March.
Distribution.—China; Australia; Tropical and S. Africa. India—Punjab plains, W. Himalaya, alt. 1-3,000 ft.

337. MAZUS LOUR.

617. **Mazus rugosus** Lour. Fl. Coch. 386.

Locality.—Lahore (Stewart 2612 !); Hoshiarpur (Ait. 51 !).
Flowers.—April.

Distribution.—Afghanistan; Java; China; Japan; Philippine Isles. India—Plains in N. India, temperate and subtropical Himalaya.

338. Herpestis *GAERTN. f.*

618. **Herpestis Moniera** H. B. & K.

Locality.—Peshawar College (Quizilbash 48!); Hoshiarpur (Ait. 395!); Rawalpindi—Hussan (Ait. 584!).
Flowers.—October.
Distribution.—Marshes throughout India, ascending to 4,000 ft., Punjab to Singapore & Ceylon common. All warm countries.

LXXVIII. OROBANCHACEAE.

339. Cistanche *HOFFM. & LINK.*

619. **Cistanche tubulosa** Wight Ic. t. 1420 bis (*C. lutea* in letter press).

Locality.—Multan (* Fitzherbert!; Stewart 2824!).
Flowers.—November.
* Said to be growing on the roots of *Acacia arabica.*
Distribution.—Asia and westwards to Arabia. India—Punjab, Sind, Rajputana.

LXXIX. BIGNONIACEAE.

340. Bignonia *L.*

620. **Bignonia capreolata** L. Sp. Pl. 624.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 12975!).
Flowers.—April.
Distribution.—N. America.

341. Tecoma *JUSS.*

621. **Tecoma undulata** G. Don. Gen. Syst. IV. 223.

Locality.—Hoshiarpur (Ait. 260!).
Distribution.—Arabia. India—W. India, alt. 0-3,000 ft., Sind, Baluchistan. Punjab, Gujarat, Rajputana, extending eastwards to Jummna.

622. **Tecoma australis** R. Br.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 14873!).
Flowers.—March.
Distribution.—Australia.

623. **Tecoma capensis** Lindl.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13764!).
Flowers.—September.
Distribution.—S. Africa.

624. **Tecoma grandiflora** Delaun.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13654!, 13653!).
Flowers.—May-September.
Distribution.—Indigenous to China and Japan. Cultivated in India in gardens in the plains and on the hills.

625. **Tecoma jasminoides** Lindl.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 12960!).
Flowers.—April.
Distribution.—Australia.

626. **Tecoma radicans** Juss.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13641 !).
Flowers.—June.
Distribution.—N. America.

627. **Tecoma Stans** Juss.

Locality.—Jullandur—Phillur Rest House (Parker 8957 !).
Flowers.—February.
Distribution.—S. and N. America.

342. DOLICHANDRA *Cham.*

628. **Dolichandra cynanchoides** Cham.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13626 !).
Flowers.—September.
Distribution.—Brazil ; S. America.

343. JACARANDA *JUSS.*

629. **Jacaranda ovalifolia** R. Br.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13188 !).
Flowers.—April.
Distribution.—S. America.

344. PHYLLARTHRON *DC.*

630. **Phyllarthron comorense** DC. Prod. IX, 244.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13770 !, 13773 !, 13776 !).
Flowers.—September.
Distribution.—Comoro Islands.

345. KIGELIA *DC.*

631. **Kigelia pinnata** DC.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13129 !).
Flowers.—April.
Distribution.—Tropical Africa.

LXXX. PEDALIACEAE.

346. PEDALIUM *L.*

632. **Pedalium Murex** L. DC. Prodr. IX, 256.

Locality.—Gurgaon (Ram Balab 3017 !).
Distribution.—Ceylon ; Trop. Africa. India—Deccan Peninsula.

LXXXI. ACANTHACEAE.

347. THUNBERGIA *L.*

633. **Thunbergia fragrans** Roxb. Cor. Pl. I, 47. and Fl. Ind. III, 33.

Locality.—Hoshiarpur (Ait. 489 !).
Cultivated.
Distribution.—Ceylon ; Malaya to the Philippines and N. Australia. Throughout India, alt. 1-4,000 ft.

348. HYGROPHILA *Br.*

634. **Hygrophila polysperma** T. Anders. in Journ. Linn. Soc. XI, 456.

Locality.—Hoshiarpur (Ait. 610 !).
Distribution.—Kabul. Throughout India in wet places, alt. 0-5,000 ft.

349. RUELLIA *L.*

635. **Ruellia patula** Jacq. Misc. Bot. II, 358 and Ic. Pl. Rar. I, t. 119,

Locality.—Hissar (Duthie 4285 !).
Flowers.—August.
Distribution.—India—Deccan Peninsula extending to Sind, Rajputana and Bundelkhand.

350. DAEDALACANTHUS *T. ANDERS.*

636. **Daedalacanthus nervosus** T. Anders. in Journ. Linn. Soc. IX, 487.

Locality.—Rawalpindi—Nand Kot 4,000 ft. (Jerram 7802 !, 7806 !).
Distribution.—India—base of the Himalaya, alt. 1-3,000 ft. from the Punjab to Bhotan frequent. Cultivated in various tropical countries.

351. AECHMANTHERA *NEES.*

637. **Aechmanthera tomentosa** Nees in Wall. Pl. As. Rar. III, 87.

Locality.—Hoshiarpur (Ait. 540 !).
Distribution.—India—Temperate Himalaya, alt. 3-5,000 ft., Kumaon.

352. STROBILANTHES *BLUME.*

638. **Strobilanthes glutinosus** Nees in Wall. Pl. As. Rar. III, and 86 in DC. Prodr. XI, 144.

Locality.—Rawalpindi—Murree 6,000 ft. (Ait. !).
Distribution.—India—Kashmir, Gharwal, Kumaon. Nepal.

639. **Strobilanthes anisophyllus** T. Anders. in Cat. Hort. Calcutt. 43 and in Journ. Linn. Soc. IX, 478.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 11535 !).
Flowers.—February.
Distribution.—Himalayas.

353. BLEPHARIS *JUSS.*

640. **Blepharis sindica** Stocks; T. Anders. in Journ. Linn. Soc. IX, 500.

Locality.—Multan (Monro 217 !); Hissar (Duthie 4138 !; Harsukh 20689 !).
Flowers.—August-October.
Distribution.—India—Sind, Punjab, Rajputana.

354. BARLERIA *L.*

641. **Barleria cristata** L. Benth. Fl. Hongk. 262.

Locality.—Rawalpindi (Ait. 215 !); Hoshiarpur (Ait. 270 !).
Flowers.—September.
Distribution.—Malaya; China. Subtropical India, N.-W. Himalaya, Burma, Central India, Nilgiris common, gardens of India.

355. LEPIDAGATHIS *WILLD.*

642. **Lepidagathis purpuricaulis** Nees in Wall. Pl. As. Rar. III, 96 and Mongr. Lepidg 27.

Locality.—Hoshiarpur (Ait. 590 !).
Distribution.—Himalayan Region. Burma.

643. **Lepidagathis hyalina** Nees in Wall. Pl. As. Rar. III, 95 and Mongr. Lepidag. 16.

Locality.—Hoshiarpur (Ait. 591 !).
Distribution.—Burma; S. China. Throughout N. India, alt. 0-4,000 ft.

356. JUSTICIA *L.*

644. **Justicia Gendarussa** Linn. f. Suppl. 85.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13127 !).
Flowers.—May.
Distribution.—Malaya and China to the Philippines. Throughout India, often an escape from cultivation.

645. **Justicia quinqueangularis** Koen.; Roxb. Fl. Ind. ed. Carey & Wall, I, 134.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 38816 !); Rawalpindi (Ait. 218 !).
Flowers.—August-September.
Distribution.—India—Central India common, from Bengal & Agra to Belgaum.

357. ADHATODA *NEES.*

646. **Adhatoda Vasica** Nees in Wall. Pl. As. Rar. III, 103 and in DC. Prodr. XI, 387.

Locality.—Rawalpindi (Ait. 495 !).
Flowers.—March.
Distribution.—Malaya, S.-E. Asia. India, common, frequently cultivated.

358. JACOBINIA *MORIC.*

647. **Jacobinia tinctoria** Hemsl. Biol. Centr. Am. Bot. ii, 522.

Locality.—Lahore—Ag. Hort. Gdns. (Mustoe 6374 !); Ferozepore (Peck 3585 !, 3393 !).
Flowers.—April-June.
Distribution.—Guatemala.

359. RUNGIA *NEES.*

648. **Rungia parviflora** Nees in Wall. Pl. As. Rar. III, 110 and in DC. Prodr. XI 469, excl. syn.

Locality.—Hoshiarpur (Ait. 479 !).
Distribution.—India—S. Deccan Peninsula. Ceylon.

360. DICLIPTERA *JUSS.*

649. **Dicliptera Roxburghiana** var. *bupleuroides* Nees in Wall, Pl. As. Rar. III and in DC. Prodr. XI 485, excl. syn. Roxb. (sp.).

Locality.—Rawalpindi (Ait. 217 !, 216 !); Hoshiarpur (Ait. 247 !); Lahore—Changa Manga (Parker 24132 !, 24136 !).
Flowers.—September-December.
Abundant in sandy places.
Distribution.—Afghanistan. Throughout India in the hills, alt. 1-6,000 ft.; abundant in the north, becoming rare in the Malabar Ghats, in the Himalayas from Kashmir to Upper Assam and Chittagong hills; the Central India.

361 PERISTROPHE *NEES.*

650. **Peristrophe bicalyculata** Nees in Wall. Pl. As. Rar. III, 11 and DC. Prodr. XI, 496.

Locality.—Multan (Monro 237 !).
Distribution.—Tropical Africa. Tropical and subtropical India, from the Punjab, Rajputana, Sind to Assam, Madras very common. Not known from Ceylon.

LXXXII. VERBENACEAE.

362. LANTANA *L.*

651. **Lantana indica** Roxb. Hort. Beng. 46 and Fl. Ind. III, 89.

Locality.—Rawalpindi (Ait. 87 !).
Flowers.—July.
Distribution.—Ceylon. Tropical Africa. Throughout India in the warmer parts common, on the river banks of Bengal one of the commonest weeds. Baluchistan.

652. **Lantana Camara** L.

Locality.—Peshawar College (Quizilbash 60 !) ; Gurdaspur, Madhopur (*Parker 14391 !).
Flowers.—November.
* Naturalised and abundant, said to be poisonous to the cattle, which however do not eat these plants and also to camels. Camels are not allowed to browse loose in this district owing to it (abstract from Parker's note).
Distribution.—A native of Tropical America, has run wild in India specially in the Bhabar in U.P. and in W. Peninsula and Ceylon.

363. LIPPIA *L.*

653. **Lippia nodiflora** Rich. in Michz, Fl. Bor. Amer. II, 15.

Locality.—Peshawar College (Quizilbash 12 !) ; Rawalpindi (Ait. 506 !) ; Lahore (Stewart 2829 !).
Flowers.—April-May.
Distribution.—Ceylon ; all tropical and warm temperate regions. Throughout India in wet grass, abundant.

364. STACHYTARPHETA *VAHL.*

654. **Stachytarpheta mutabilis** Vahl.

Locality.—Lahore—Ag. Hort. Gdns. (Mostoe 6375 !) ; Parker (13765 !).
Flowers.—September.
Distribution.—Venezuela. W. India.

365. VERBENA *L.*

655. **Verbena officinalis** L. : Schauer in DC. Prodr. XI, 547.

Locality.—Lahore (Stewart 2620 !) ; Rawalpindi (Ait. 254 !).
Flowers.—April-September.
Distribution.—Temperate and subtropical regions. India—Himalaya, alt. 1-6,000 ft. from Kashmir to Bhotan frequent, Bengal plain to the Sunderbunds frequent.

656. **Verbena bonariensis** L.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 38863 !).
Flowers.—August.
Weed in gardens.
Distribution.—Tropical regions.

657. **Verbena bipinnatifida** Schau.

Locality.—Lahore—Changa Manga (Parker 19556 !).
Flowers.—May.
A perennial herb cultivated in gardens in the Punjab, e.g. Lahore, Shahdara etc., comes up freely, self sown in moist shady plains. Flowers blue or white. (Parker).
Distribution.—N. America.

366. PETREA *HOUST.*

658. **Petrea volubilis** Linn. Sp. Pl. 626.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 15030 !).
Flowers.—April.
Distribution.—Tropical America.

367. CITHAREXYLUM *MILL.*

659. **Citharexylum quadrangulare** Jacq. Enum. Pl. Carib. 26.

Locality.—Ferozepore (Barvoin 5608 !).
Flowers.—August.
Distribution.—W. India.

660. **Citharexylum spinosum** Linn. Sp. Pl. 625.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 38780 !, 17193 !, 17196 !).
Flowers.—August-October.
Distribution.—Barbados Islands.

368. CALLICARPA *L.*

661. **Callicarpa macrophylla** Vahl. Symb. III, 13 t. 53.

Locality.—Rawalpindi 4,000 ft. (Jerram 8496 !).
Flowers.—July.
Distribution.—Throughout N. and E. India, ascending to 6,000 ft. in the W. Himalaya, Deccan Peninsula.

662. **Callicarpa Reevesii** Wall. Cat. 1830.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13778 !); Lawrence Gdns. (Parker 11563 !).
Flowers.—September-November.
Distribution.—S. China.

663. **Callicarpa purpurea** Juss.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13648 !, 13669 !).
Flowers.—June.
Distribution.—China.

369. TECTONA *L. f.*

664. **Tectona grandis** Linn f. Suppl. 151.—The Teak, cultivated.

Locality.—Hoshiarpur (Ait. 490 !).
Distribution.—Burma; Malay Peninsula alt. 500-4,000 ft.; Sumatra; Java. India—W. Deccan Peninsula, alt. 500-4,000 ft., common; from Central India to Orissa.

370. PREMNA *L.*

665. **Premna scandens** Roxb. Fl. Ind. III, 82.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13729 !).

Flowers.—May.
Distribution.—India—Tarai of N. and E. Bengal, Assam.

666. **Premna latifolia** Roxb. Hort. Beng. 46 and Fl. Ind. III, 76.

Var.—*mucronata* C.B.Cl.
Locality.—Hoshiarpur (Parker 15045 !); Gurdaspur (Fane ex Engincor 4858 !; Bisram 301 !).
Flowers.—June-August.
Distribution.—N. India from Kumaon to Bhotan ascending to 5,000 ft. and spreading into Bengal Plains, common.

371. Vitex *L.*

667. **Vitex Negundo** L. Roxb. Fl. Ind., III, 70.

Locality.—Hoshiarpur (Ait. 380 !).
Distribution.—Ceylon; Kabul; E. Asia to the Philippines. Throughout India, in the warmer zone a universal plant.

668. **Vitex leucoxylon** Linn. f. Suppl. 293.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13805 !, 13657 !).
Flowers.—May.
Distribution.—S. Deccan Feninsula and Ceylon upto 3,000 ft.

669. **Vitex Agnus-castus** Linn. Sp. Pl. 638.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 14385 !).
Flowers.—June-July.
Distribution.—Mediterranean region; Orient.

372. Clerodendron *L.*

670. **Clerodendron inerme** Gaertn. Fruct. I, 271, t. 57, fig. 1.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13650 !).
Flowers.—May.
Distribution.—India and Ceylon near the sea.

671. **Clerodendron phlomoides** Linn. f. Suppl. 292.

Locality.—Lahore—Changa Manga (Parker 13774 !); Hissar (Harsukh 20680 !).
Flowers.—September.
Distribution.—From the N.-W. Himalaya Tarai to Ceylon; general in the drier climates, extending to Bihar and Orissa.

672. **Clerodendron infortunatum** Gaertn. Fruct., I, 271, t. 57, fig. 1.

Locality.—Lahore—Ag. Hort. Gdns. (Mustoe 6381 !).
Flowers.—April.
Distribution.—Malaya. Throughout India, from Gharwal and Assam to Ceylon and Singapore, in the warm region, very common.

673. **Clerodendron Siphonanthus** Br. in Ait. Hort Kew. ed. 2, IV, 65.

Locality.—Hoshiarpur (Ait. 528 !).
An indigenous plant in the low hills also cultivated in gardens (Ait.).
Distribution.—Sumatra; extensively cultivated in both hemispheres. India—Mts. of S. Deccan Peninsula, Kumaon.

674. **Clerodendron fragrans** Ait.

Locality.—Hoshiarpur (Ait. 558 !).
Cultivated.

675. **Clerodendron aculeatum** Linn.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13114 !, 6366 !).
Flowers.—April.
Distribution.—America.

676. **Clerodendron heterophyllum** R. Br. in Ait. Hort. Kew. ed. II, IV, 64.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 38864 !, 13769 !, 6370 !).
Flowers.—August.
Distribution.—Madagascar.

677. **Clerodendron Thomsonae** Balg. in Edinb. New. Phil. Journ. N. S. XV. (1862) 233.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13730 !).
Flowers.—May.
Distribution.—Tropical Africa.

373. HOLMSKIOLDIA *RETZ.*

678. **Holmskioldia sanguinea** Retz. Obs. VI, 31, and in Hoffm. Phyt. Blaett. 35, t. 3.

Locality.—Hoshiarpur (Ait. 559 !).
Indigenous in the low hills, forest near Hoshiarpur and also cultivated in gardens and an escape (Ait.).
Distribution.—India—subtropical Himalaya, alt. 0-4,000 ft. from Kumaon to Bhotan.

374. CARYOPTERIS *BUNGE.*

679. **Caryopteris Wallichiana** Schauer in DC. Prodr. XI, 625.

Locality.—Rawalpindi—Kachut 4,000 ft. (Jerram 7781 !, 7780 ! ; Hoshiarpur (Ait. 568 !).
Flowers.—April.
Distribution.—India—subtropical Himalaya, alt. 0-4,500 ft., from the Punjab to Bhotan, frequent.

680. **Caryopteris grata** Benth. in Gen. Pl. II, 1158.

Locality.—Rawalpindi—4,500-5,500 ft. (Jerram 8094 !) ; Dhirkot (Jerram 7355 !, 7356 !, 7327 !).
Flowers.—January-February.
Pericarp of fruit red when ripe.
Distribution.—India—Kumaon, below Naini Tal, alt. 4,000 ft.

LXXXIII. LABIATAE.

375. OCIMUM *L.*

681. **Ocimum americanum** L. Cent. Pl. I, 15 ; Amoen Acad IV, 276 = *canun.*

Locality.—Pabbi Hills (* Parker 24228 !).
Flowers.—December.
* Small shrub 2 ft. high with a different aroma to *basilicum.*
Distribution.—Asia and Tropical Africa.

682. **Ocimum Basilicum** L.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 11536 !).
Flowers.—February ; Shrubby.
Distribution.—Ceylon ; Malacca ; hotter W. Asia ; Africa ; the Malay and Pacific Islands. Throughout tropical and hotter India—cultivated from the Punjab to Ava, indigenous in the Punjab on low hills.

683. **Ocimum gratissimum** L.

Locality.—Lahore—Ag. Hort. Gdns. (*Parker 13660 !, 13659 !, 13661 !).
Flowers.—May.
A shrub 3 ft. high, stem woody.
Distribution.—E. Nepal; Ceylon; Java; Tropical Africa and America. India—Bengal, Chittagong and throughout the Deccan Peninsula.

376. PLECTRANTHUS *L'HERIT.*

684. **Plectranthus rugosus** Wall. Pl. As. Rar. II, 17 and Cat. 2745.

Locality.—Rawalpindi, Barrakow Trete (Ait. 496 !).
Flowers.—August.
Distribution.—Afghanistan. India—W. Himalaya, dry hills from Kashmir to Gharwal, alt. 3-8,000 ft.

377. POGOSTEMON *DESF.*

685. **Pogostemon plectranthoides** Desf. in Amm. Mus. II, 156, t. 6.

Locality.—Hoshiarpur (Ait. 472 !).
Distribution.—India—W. Himalaya, lower Bengal and Bihar, Konkan, Canara, Circars.

378. MENTHA *L.*

686. **Mentha sylvestirs** Linn.

Locality.—Peshawar College (Quizilbash 461 !).
Distribution.—Afghanistan; Temperate Europe and W. and C. Asia. India—Temperate W. Himalaya.

379. THYMUS *L.*

687. **Thymus vulgaris** Linn. Sp. Pl. 591.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13124 !).
Flowers.—May.
Distribution.—S. Europe; N. Asia.

380. MICROMERIA *BENTH.*

688. **Micromeria biflora** Benth. Lab. 378 and in DC. Prodr. XII, 220.

Locality.—Gurdaspur—Siyaparkandi (Bisram 844 !).
Flowers.—May.
Distribution.—Afghanistan; Arabia; Abyssinia; S. Africa. India—tropical and temperate Himalaya, Nilgiri and Anaimalai Hills.

381. MERIANDRA *BENTH.*

689. **Meriandra bengalensis** Benth. Lab. 189. in Wall. Pl. As. Rar I., 29. and in DC. Prodr. XII, 262.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 14872 !).
Flowers.—April.
Distribution.—India, cultivated. Native of Abyssinia.

382. SALVIA *L.*

690. **Salvia plebeia** Br. Prodr. 501.

Locality.—Lahore (Stewart 2897 !, 2898 !, 2680 !, 2622 !); Hoshiarpur (Ait. 574 !).
Flowers.—April.
Distribution.—China; Malay Islands; Australia. Throughout India, in the plains and ascending the hills to 5,000 ft.

691. **Salvia aegyptiaca** Linn.

Locality.—Rawalpindi (Ait. 499 !).
Flowers.—April.
Distribution.—Afghanistan; W. Asia; N. Africa to the Cape Verde Islands. India—Punjab plain, Sind, Rajputana from Delhi westwards, alt., 1-2,000 ft.

383. NEPETA *L.*

692. **Nepeta graciliflora** Benth. in Wall. Pl. As. Rar. I, 65; Lab. 476 and in DC. Prodr. XII, 382.

Locality.—Rawalpindi—Mt. Tilea (Ait. 1101 !).
Flowers.—March.
Distribution.—India—Punjab Plains from Hardwar to the Indus and sub-tropical Himalaya, ascending to 4,000 ft.

384. LALLEMANTIA *FISCH & MEY.*

693. **Lallemantia Royleana** Benth. in DC. Prodr. XII, 404.

Locality.—Lahore (Stewart 2567 !); Rawalpindi Hussad (Ait. 1100 !).
Flowers.—March.
Distribution.—Afghanistan; Persia; Turkestan. India—Punjab plains and hills.

385. SCUTELLARIA *L.*

694. **Scutellaria repens** Ham. in Don. Prodr. 110.

Locality.—Hoshiarpur (Ait. 543 !); Gurdaspure—Dhunera (Bisram 303 !).
Flowers.—June.
Distribution.—India—subtropical Himalaya, Ava.

386. ANISOMELES *Br.*

695. **Anisomeles ovata** Br. in Ait. Hort. Kew. ed. 2, II, 364.

Locality.—Rawalpindi—Barrakow to Trete (Ait. 500 !).
Flowers.—September.
Distribution.—Malay Archipelago; China; Philippines. Tropical and sub-tropical India, Indus to Assam, ascending the Himalaya to 5,000 ft. and south to Ceylon.

387. STACHYS *L.*

696. **Stachys parviflora** Benth. in DC. Prodr. XII, 490.

Locality.—Rawalpindi, Fattehgunj (Ait. 497 !, 501 !).
Flowers.—April-August.
It was strongly scented of Peppermint.
Distribution.—Afghanistan. India—Punjab plains and hills, from the Jhelum eastwards and northwards to Murree.

388. OTOSTEGIA *BENTH.*

697. **Otostegia limbata** Benth. mss.

Locality.—Rawalpindi, 3,500-5,000 ft. (Jerram 7895 !).
Flowers.—May.
Distribution.—India—Punjab, lower hills in rocky places west of the Jhelum to the salt range.

389. Leucas *Br.*

698. **Leucas urticaefolia** Br. Prodr. 504.

Locality.—Hissar (Harsukh 20696 !).
Flowers.—October.
Distribution.—Arabia : Abyssinia. India—Rajputana, Upper Gangetic Plain, from Patna to the Punjab and southwards to Sind, Coromandel and Malabar. Baluchistan.

390. Ajuga *L.*

699. **Ajuga bracteosa** Wall. Cat. 2032.

Locality.—Lahore—Changa Manga (Gamble 22497 !) ; Rawalpindi, Barrakow (Ait. 505 !).
Flowers.—January-April.
Distribution.—Afghanistan ; China ; Japan ; Abyssinia. India—W. Himalaya alt. 1-7,000 ft. and in the plains near them from Oudh to Peshawar.

LXXXIV. PLANTAGINACEAE.

391. Plantago *L.*

700. **Plantago amplexicaulis** Cav. Ic. II, 22, t., 125. *var.—camphula* Edgew.

Locality.—Lahore (Stewart 2536 !, 2537 !) ; Rawalpindi (Ait. 508 !).
Flowers.—March-May.
Distribution.—India—Punjab Plains, Sind. Westwards to Greece and Egypt.

701. **Plantago ovata** Forsk. Fl. Aeg. Arab. 31.

Locality.—Rawalpindi (Ait. 507 !) ; Lyallpur (Inayat brother !) ; Multan (Monro 256 !) ; Lahore (Stewart 2820 !, 2535 !).
Flowers.—April-November.
Cultivated in Jalalpur.
Distribution.—India—Punjab plains and low hills, from the Sutlej westwards. Westwards to Spain and the Canaries.

702. **Plantago Psyllium** L.

Locality.—Peshawar College (Quizilbash 24 !), near Khyber Pass at Jamrud (Milne !).
Distribution.—India—N.-W. Punjab. Westwards to Greece and Egypt.

LXXXV. NYCTAGINACEAE.

392. Boerhaavia *L.*

703. **Boerhaavia repens** Linn.

Locality.—Hissar (Duthie 4327 !) ; Lahore (2962 !) ; Multan !.
Flowers.—August.
Distribution.—Ceylon ; Tropical and subtropical Asia ; Africa and America. Throughout India, from the Punjab to Assam and south to Travancore and Singapore, ascends in the hot Himalayan valleys to 7,000 ft.

LXXXVI ILLECEBRACEAE.

393. Herniaria *L.*

704. **Herniaria hirsuta** Linn.

Locality.—Lyallpur (Inayat brother !) ; Rawalpindi (Ait. 509 !).
Flowers.—March.
Distribution.—India—W. Himalaya, from Kashmir to Kumaon alt. 4-8,000 ft., the Punjab from the Sutlej to Peshawar. Westwards to the Atlantic and the Canary Islands.

LXXXVII. AMARANTACEAE.

394. Deeringia *Br.*

705. **Deeringia celosioides** Br. Prodr. 413.

Locality.—Hoshiarpur (Ait. 510 !).
Distribution.—Malay Islands; China; Australia. India—subtropical Himalaya.

395. Celosia *L.*

706. **Celosia argentea** Linn.

Locality.—Rawalpindi (Ait. 225 !).
Flowers.—September.
Distribution.—Tropical Asia; Africa; America. Cultivated or introduced. Throughout India and Ceylon, ascending the hills to 4,000 ft., nowhere really indigenous.

396. Bosia *L.*

707. **Bosia Amherstiana** Hook f.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13618 !).
Flowers.—April.
Distribution.—India—W. temperate Himalaya, alt. 4-7,000 ft.

397. Digera *FORSK.*

708. **Digera arvensis** Forsk. Fl. Aeg. Arab. 65. Moq. in DC. Prodr, XIII, 2, 324.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 38818 !); Hissar (Hursukh 20694 !); (Lahore 29 !, 2959 !); Rawalpindi (Ait. 566 !) * Multan (25 ! Forest Department).
* Average fodder for cattle. No fodder for ponies. Also eaten by poorer classes as vegetable.
Distribution.—Ceylon—N. part of the island; Java; Afghanistan and Baluchistan to Arabia and N. Africa. India—Rajputana, Sind, Bengal and N.-W. India in the plains to Peshawar and the Salt Range, S. Deccan.

398. Amarantus *L.*

709. **Amarantus viridis** Linn. Sp. Pl. 1405.

Locality.—Multan—Sakmurrat (Monro 28 !); Rawalpindi (Ait. 525 !).
Flowers.—April-May.
Distribution.—All tropical and warm countries. Throughout India in waste places.

710. **Amarantus Blitum** Linn. Sp. Pl. 990.

Locality.—Lahore (24 ! Forest Department; 3000 ! Brandis Herb.; Stewart 2818 !, 2817 !; Cleghorn 2655 !); Rawalpindi (Ait. 523 !).
Flowers.—March.
Distribution.—Temperate and tropical regions. Waste places throughout India and Ceylon.

711. **Amarantus polygamus** Linn. Amoen. Acad. IV, 294. (not of Roxb.).

Locality.—Hissar (Duthie 4329 !).
Flowers.—August.
Distribution.—All hot countries. Throughout India and Ceylon, abundant.

399. Pupalia *JUSS.*

712. **Pupalia lappacea** Moq. in DC. Prodr. XIII, 2, 331.

Locality.—Rawalpindi (Ait. 524 !); Hoshiarpur (Ait. 37 !).
Flowers.—July.
Distribution.—Tropical Asia and Africa. India—Upper Gangetic Valley and Punjab, W. tropical Himalaya, alt. 1-3,000 ft., from Kashmir to Kumaon, Bihar, Sind, Rajputana, Gujarat and the Deccan Peninsula.

400. Aerua *FORSK.*

713. **Aerua javanica** Juss. in Ann. Mus. XI, 131.

Locality.—Montgomery (Champion 45326 !; Parker 10002 !); Rawalpindi (Ait. 225 !, 226 !); Hurroo Bridge—(Ait. 562 !, 565 !); Lahore (Stewart 2597 !, 2596 !; Cleghorn 2649 !); Hissar (Duthie 4328 !; Harsukh 20691 !); Multan (Duthie).
Flowers.—October-December.
Distribution.—Burma; Ceylon; westwards to Arabia; W. & E. Tropical Africa, and the Cape Verde Islands. India—from Oudh Terai to the Punjab, Sind, Central India, the Deccan from the Konkan southwards.

714. **Aerua scandens** Wall. Cat. 6911. excl. M.

Locality.—Rawalpindi—Barrakow (Ait. 522); Gurdaspur—Siyapurkandi (Bisram 843 !).
Flowers.—May.
Distribution.—China; Malay Islands; Philippines; E. and W. Tropical Africa. India—Plains of Bengal and from Assam to the Punjab, ascending the Himalaya to 5,000 ft. from Kumaon to Bhotan, Central India, Bihar and the summit of Parasnath.

401. Achyranthes *L.*

715. **Achyranthes aspera** Linn. Sp. Pl. 204.

Locality.—Hissar (Duthie 4331 !); Hoshiarpur (Ait. 284 !).
Flowers.—August.
Distribution.—Tropical Asia; Africa; Australia and America. Throughout India and Ceylon, an abundant weed in dry places.

402. Alternanthera *FORSK.*

716. **Alternanthera sessilis** Br. Prodr. 417.

Locality.—Peshawar (Quizilbash 27 !); Hissar (Duthie 4333 !); Rawalpindi (Ait. 690 !); Lahore (Stewart 2626 !, 2819 !).
Flowers.—April-October.
Distribution.—All warm countries. Throughout hotter India and Ceylon, in damp places, ascending the Himalaya to 4,000 ft.

LXXXVIII. CHENOPODIACEAE.

403. Chenopodium *L.*

717. **Chenopodium album** Linn.

Locality.—Peshawar College (Quizilbash 14 !); Rawalpindi (Ait. 520 !); Barrakow (Ait. 519 !); Changa Manga (* Parker 14379 !, 14380 !).
Flowers.—March-July.
* Worst weed in C. M. It reaches a height of 10 ft. (From Parker's note).
Distribution.—India—Tropical and temperate Himalaya, the plains of Bengal, the Gangetic valley and the Punjab, Sind, Rajputana, Deccan Peninsula. Ubiquitous.

718. **Chenopodium murale** Linn. Sp. Pl. 219.

Locality.—Lahore—(Stewart 2816 !); Ag. Hort. Gdns. (Parker 21751 !).
Flowers.—March.
Weed in wheat crop.
Distribution.—India—Upper Gangetic valley and the Punjab, Deccan Peninsula. Ceylon, ubiquitous.

719. **Chenopodium Botrys** Linn. Sp. Pl. 219.

Locality.—Rawalpindi, Hurroo (Ait. 588 !).
Flowers.—October.
Distribution.—Europe; N. and W. Asia; N. Africa, introduced into America. India—Temperate Himalaya, alt. 4-10,000 ft.

720. **Chenopodium ambrosioides** Linn. Sp. Pl. 219.

Locality.—Rawalpindi (Ait. 223 !).
Flowers.—September.
Distribution.—Widely spread in the Old World, introduced into America. India—Bengal, Silhet and the Deccan.

404. Spinacia *L.*

721. **Spinacia oleracea** Linn. Sp. Pl. 1027.

Locality.—Lahore (Stewart 2803 !).
Flowers.—March.
Distribution.—Cultivated throughout India.

405. Atriplex *L.*

722. **Atriplex crassifolia** C. A. Mey. in Ledeb. Fl. Alt. IV, 309.

Locality.—Rawalpindi (Ait. 224 !).
Flowers.—September.
Distribution.—India—N.-W. India and the Punjab, from Jummna westwards.

723. **Atriplex nummularia** Lindl. in Mitch. Journ. Trop. Austr. (1848) 64.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 14880 !).
Flowers.—February.
Distribution.—Australia.

406. Kochia *ROTH.*

724. **Kochia prostrata** Schrad. Neue. Journ. 1809, 85.

Locality.—Karnal !
Distribution.—Spain and N. Africa; Siberia; Central Asia. India—western Himalaya, in the dry regions of Kunwar and Zanskar.

725. **Kochia indica** Wight. Ic. t. 1791. Vern. n. Bui.

Locality.—Lahore (Parker 39057 !; Stewart 2641 !, 2520 !); Rawalpindi, Huzroo (Ait. 689 !).
Flowers.—March-October.
Abundant in the Punjab and sometimes a troublesome weed. On freshly irrigated somewhat saline soil. After a few years when the salts are washed out of the soil it disappears.
An annual, sometimes reaching 6-8 ft. high. In autumn twigs become rather woody and a tall patch of it is very difficult to break through.
Distribution.—Afghanistan. India—N.-W. India, from Delhi to Indus common, Deccan Peninsula, salt soils at Coimbatore.

407. Suaeda *FORSK.*

726. **Suaeda fruticosa** Forsk. Fl. Aeg. Arab. 70.

Locality.—Sirsa (Drum 36956 !, 36957 !); Lahore (Stewart 2812 !, 2813 !, Cleghorn 2656 !).
Flowers.—April-December.
Distribution.—The Atlantic; Africa and America. N.-W. India, from Delhi and throughout the Punjab, westwards to the Indus, common in the plains.

408. Haloxylon *BUNGE.*

727. **Haloxylon recurvum** Bunge in Boiss. Fl. Orient. IV, 949.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 14337 !); Sirsa (10096 !, 10055 !, 10056 !, 10057 !, 10058 !, 10059 !, 10060 !, 10063 !, 10064 !, 10066 !, 10067 !, 10068 !, 10069 !, 10073 !); Multan (Monro !); Salt Range (Naraindas 10061 !; Drum 36934 !, 3018 !).
Flowers.—September-December.
Distribution.—Afghanistan; Yunnan. India—W. Punjab plains and Salt Range ascending to 2,500 ft., Rajputana, Sind.

728. **Haloxylon salicornicum** Bunge in Boiss. Fl. Orient. IV, 949.

Locality.—Peshawar College (Quizilbash 4 !); Lahore, Rakh chunian (Parker 14334 !).
Flowers.—October.
Distribution.—Afghanistan. India—Rajputana; Sind. Baluchistan.

729. **Haloxylon multiflorum** Bunge in Boiss. Fl. Orient. IX, 949.

Locality.—Multan (Monro).
Flowers.—December.
Distribution.—Afghanistan. India—N.-W. Punjab plains, Rajputana.

409. Salsola *L.*

730. **Salsola Kali** Linn.; Boiss. Fl. Orient. IV, 954.

Locality.—Peshawar College (Quizilbash 47 !).
Distribution. Atlantic; N. Asia; N. and S. Africa; Australia and N. America. India—N.-W. Punjab.

731. **Salsola foetida** Del. Fl. Aegypt. 57.

Locality.—Lahore—Kot Lakhpat (Parker 14330 !, 14331 !); Changa Manga—unirrigated area (Parker 14332 !, 14333 !; Gamble 22495 !); Multan (Monro 10794 !); Hissar (* Duthie 4335 !); Shahpur, Daphar (Parker 2392 !); Lahore (Stewart 2521 !).
Flowers.—August-March.
Distribution.—Persia; Arabia; N. Africa. India—Punjab plains, upper Gangetic plain, Rajputana, Sind. Baluchistan.

LXXXIX. PHYTOLACCACEAE.

410. Rivina *PLUM.*

732. **Rivina humilis** Linn. Sp. Pl. 121.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13768 !).
Flowers.—September.
Distribution.—Tropical America.

411. PHYTOLACCA *L.*

733. **Phytolacca dioica** Linn. Sp. Pl. ed II, 631.

Locality.—Lahore—Ag. Hort. Gdns. (* Parker 38639 !, 17194 !, 13772 !).
Flowers.—May-October.
* Introduced in 1912 from seed from Vilmorin. Doing well and does not suffer from heat or frost in Lahore. This tree is commonly grown in Gibraltar.
Distribution.—S. America.

XC. POLYGONACEAE.

412. CALLIGONUM *L.*

734. **Calligonum polygonoides** Linn. Sp. Pl. (1753) 530.

Locality.—Multan Khanewal (* Parker 18076 !, 18075 !, Elliot !); Muzzafargarh (** Wingate ! ; Monro 305 !).
Flowers.—January-April.
* According to Brandis [*Indian Trees*, p. 521] this plant is found as far north as Lahore. This statement is, I believe, untrue. I have not seen it anywhere in either Lahore or Montgomery Districts. On the railway from Lahore to Karachi it starts suddenly at Mian Channa just within the border of Multan District. It is always found on sand dunes (Parker.).
** The flowers are eaten by the poorer classes of people.
Distribution.—Persia ; Armenia ; Syria. India—the Punjab, Rajputana, Sind.

413. POLYGONUM *L.*

735. **Polygonum plebejum** Br. Prodr. 420.

Locality.—Peshawar College (Quizilbash 3 !) ; Lahore (Stewart 2806 !, 2605 !, 2663 !, 2545 !).
Flowers.—April.
Distribution.—Afghanistan ; Tropical Asia ; Java ; Philippines ; Australia ; Madagascar ; Egypt ; Tropical and S. Africa. India—Rajputana, Sind.

736. **Polygonum plebejum** Br. var. *indica.*

Locality.—Lahore (Stewart 2807 !).
Flowers.—April.
A common Australian and African form.

737. **Polygonum plebejum** Br. var. *brevifolia.*

Locality.—Multan (* Monro 261 !).
Flowers.—March.
* Eaten greedily by cattle.
Distribution.—India ; Africa.

738. **Polygonum plebejum** Br. var. *micranthema.*

Locality.—Lahore (2617 !, Stewart 2509 !).
Flowers.—April.
Distribution.—India.

739. **Polygonum barbatum** Linn.

Locality.—Rawalpindi (Ait. 222 !).
Flowers.—September.
Distribution.—Tropical Asia and Africa. Throughout the hotter parts of India.

740. **Polygonum serrulatum** Lagasc. Boiss. Fl. Orient. IV, 1028.

Locality.—Lahore (Stewart 2804 !).
Flowers.—April.

Distribution.—W. Asia; S. Europe; Africa; America; Australia. Plains and low hills of India.

741. **Polygonum Hydropiper** Linn.

Locality.—Hoshiarpur (Ait. 47 !); Lahore (3006 !).
Distribution.—Europe and N. Africa; Temperate and subtropical Asia; Java; N. America; Australia. Plains and hills of India, in wet places.

414. RUMEX *L.*

742. **Rumex orientalis** Benth. Boiss. Fl. Orient. IV, 1009.

Locality.—Peshawar College (Quizilbash 5 !).
Distribution.—Asia Minor; Syria and Greece. India—W. Himalaya.

743. **Rumex dentatus** Linn.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 21718 !, 21719 !; Stewart 2805 !); Rawalpindi (Ait. 516 !); Hoshiarpur (Ait. 607 !).
Flowers.—March-April.
Distribution.—India.

XCI. PIPERACEAE.

415. PIPER *L.*

744. **Piper longum** Linn. Sp. Pl. 29.

Locality.—Hoshiarpur (*Ait. 493 !).
* Cultivated in gardens for market.
Distribution.—Ceylon; Malacca; Malay Islands. Hotter provinces of India from Assam, Khasia Mts. and Bengal westwards to Bombay and to Travancore, wild or cultivated.

XCII. LAURACEAE.

416. MACHILUS *NEES.*

745. **Machilus odoratissima** Nees in Wall. Pl. As. Rar. II, 70, and Syst. Laurin, 172.

Locality.—Husanabad, Abbottabad (Inayat !); Rawalpindi—Punjar (Parker 8670 !).
Flowers.—May-June.
Distribution.—Java; Sumatra; Cochin China. India—Subtropical and temperate Himalaya.

417. LITSAEA *LAMK.*

746. **Litsaea sebifera** Pers. Syn. II, 4.

Locality.—Rawalpindi 3,000 ft. (Jerram 7329 !); Gurdaspur (Fane 4861 !).
Flowers.—June.
Distribution.—Ceylon; Malay Islands; China; Australia. Throughout the hotter parts of India, from the Punjab to Assam, the Gangetic Plain and Bengal, and southwards throughout the Deccan Peninsula.

747. **Litsaea polyantha** Juss. in Ann. Mass. VI, 211.

Locality.—Gurdaspur (Fane 4860 !).
Flowers.—July.
Distribution.—Java; China. India—Punjab and the Salt Range along the foot of the Himalaya, eastwards to Assam and southwards to the Satpura Range.

XCIII. THYMELAEACEAE.

418. Daphne *L.*

748. **Daphne cannabina** Wall in Asiat. Research XIII, 315. t. 7, 8.

Locality.—Rawalpindi 5,000 ft. (Jerram 7471 !).
Flowers.—March.
Distribution.—India—temperate Himalaya.

XCIV. LORANTHACEAE.

419. Loranthus *L.*

749. **Loranthus cordifolius** Wall. in Roxb. Fl. Ind. ed Carey and Wall. II, 223 and Cat. 517.

Locality.—On road from Shahpur to Sihunta 3,000 ft. Chamba state (Parker 21614 !).
Flowers.—January.
On *Vitex Negundo.*
Distribution.—India subtropical Himalaya, Central India.

750. **Loranthus longiflorus** Desrouss. in Lamk. Encyc. III, 498.

Locality.—Rawalpindi, Saligraon (Parker 9998 !); Hoshiarpur (Ait. 502 !).
Flowers.—February.
Distribution.—India—tropical and temperate Himalaya, Gangetic plains from Oudh to Assam and southwards on plains and hills throughout both peninsulas to Travancore. Ceylon; in the warm parts.

420. Viscum *L.*

751. **Viscum japonicum** Thunnb. in Trans. Linn. Soc. II, 329.

Locality.—Rawalpindi, Murree 7,000 ft. (Ait !).
On *Quercus.*
Distribution.—Mauritius; China; Japan; Australia. India—temperate Himalaya, alt. 5-7,000 ft., Nilgiri Hills, ascending to 7,000 ft., Central Provinces in the most elevated parts.

XCV. EUPHORBIACEAE.

421. Euphorbia *L.*

752. **Euphorbia hypericifolia** Linn. Hort. Cliff. 148.

Locality.—Rawalpindi (Ait. 529 !); Hissar (Duthie 4375 !).
Flowers.—July-August.
Distribution.—Ceylon; Tropics of both the hemispheres, except Australia and the Pacific Islands. Common throughout the hotter parts of India, from the Punjab to the S. Deccan.

753. **Euphorbia hirta** Linn. Sp. Pl. (1753) 454.

Locality.—Changa Manga (42605).
Flowers.—September.
Distribution.—Throughout the hotter parts of India from the Punjab to Ceylon. All tropical and subtropical countries.

754. **Euphorbia thymifolia** Burm. Fl. Ind. 2 and Thes. Zeylan, t. 105, f. 2

Locality.—Changa Manga (Parker 42606 !); Hissar bir (Harsukh 20688 !; Duthie 437a).
Flowers.—August-October.
Distribution.—Throughout India and Ceylon in the plains and lower hills. All hot countries except Australia.

755. **Euphorbia granulata** Forsk. Fl. Aeg. Arab. 94.

Locality.—Lahore—(2661 ! ; Stewart 2533 !).
Flowers.—March-April.
Distribution.—Afghanistan ; Arabia ; Egypt ; Canaries. India—Punjab plains, Rohilkhand, Rajputana, Sind.

756. **Euphorbia Clarkeana** Hook. f.

Locality.—Lahore (Cleghorn 2647 !) ; Rawalpindi (Ait. 525 !) ; Hissar (Duthie 4374 !).
Flowers.—May-August.
Distribution.—India—N.-W. India, Rajputana, Sind.

757. **Euphorbia Tirucalli** Linn. Hort. Cliff. 147.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13616 !).
Flowers.—June.
Distribution.—India—naturalised in Bengal and the Deccan Peninsula, cultivated in N.-W. India, Burma and E. Peninsula. Ceylon naturalised ; a native of Africa.

758. **Euphorbia helioscopia** Linn. Sp. Pl. 459.

Locality.—Rawalpindi (Ait. 528 !) ; Lahore (Stewart 2839 !).
Flowers.—April.
Distribution.—Afghanistan and westwards to the Atlantic ; Japan ; introduced elsewhere. India—the Punjab and W. Himalaya in fields, introduced into the Nilgiris.

759. **Euphorbia dracunculoides** Lamk. Encycl. II, 428.

Locality.—Jhelum (Ait. !) ; Lahore (Stewart 2532 !).
Flowers.—March.
Distribution.—Arabia and Tropical Africa. India—from the Punjab to Bihar in the plains and low hills, and southward to Canara and Coromandel.

760. **Euporbia falcata** L. Sp. Pl. 456.

Locality.—Rawalpindi (Ait. 630 !).
Flowers.—March.
Distribution.—Afghanistan and westwards to Arabia, Middle and S. Europe, and N. Africa. India—the Punjab.

761. **Euphorbia prolifera** Ham. in Don Prodr. 62.

Locality.—Rawalpindi (Ait. 531 !, 532 !).
Flowers.—April-May.
Distribution.—Yunnan. India—C. and W. Himalaya, plains and rocky hills from Oudh to the Punjab.

762. **Euphorbia pulcherrima** Willd. ex Klotzsch, in Otta & Dietr. Allg. Gartenz II (1834) 27.

Locality.—Hoshiarpur (Ait. 481 !).
Distribution.—Mexico.

422. Sarcococca *LINDL.*

763. **Sarcococca pruniformis** Lindl. Bot. Reg. t. 1012.

Locality.—Rawalpindi above 5,000 ft. (Jerram 7472 !).
Flowers.—March.
Distribution.—Ceylon ; Afghanistan ; Sumatra. India—temperate Himalaya, Deccan Peninsula, on the W. Ghats from Canara southwards.

423. BUXUS *L.*

764. **Buxus papillosa** C. K. Schneider, Ill. Handb. Laubholzk II, 139 (1907)

Locality.—Peshawar College (Quizilbash 58544 !); Rawalpindi—Kala chitta (Parker 10188 !).
Flowers.—December-March.
Distribution.—India.

424. ANDRACHNE *L.*

765. **Andrachne cordifolia** Muell. Arg. in DC. Prodr. XV, 234.

Locality.—Rawalpindi over 6,000 ft. (Jerram 8277 !).
Flowers.—July.
Distribution.—Afghanistan. India—C. and W. temperate Himalaya, alt. 5-8,000 ft.

425. PHYLLANTHUS *L.*

766. **Phyllanthus Niruri** Linn. Sp. Pl. 98.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 38823 !).
Flowers.—August. A weed.
Distribution.—Ceylon; Malacca; Tropics generally except Australia. Throughout the hotter parts of India, from the Punjab to Assam and southwards to Travancore, ascending the hills to 3,000 ft.

426. GLOCHIDION *FORST.*

767. **Glochidion assamicum** Hook. f.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 14881 !).
Flowers.—March.
Distribution.—India—W. Himalaya, foot and low valleys of the Himalaya, Bengal, Assam.

768. **Glochidion velutinum** Wight Ic. t. 19071-2.

Locality.—Rawalpindi, Panjuri (Parker 10190 !).
Flowers.—February.
Distribution.—India—hot valleys of the Himalaya, Deccan Peninsula from the Konkan to the Nilgiri Hills.

427. BREYNIA *FORST.*

769. **Breynia rhamnoides** Muell. Arg. in DC. Prodr. XV, ii, 440 (excl. vars. a., r.)

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13619 !).
Flowers.—June.
Distribution.—Ceylon; Malacca; China; Malay Islands, Philippines. Throughout tropical India.

770. **Breynia cernua** Muell. Arg. in DC. Prodr. XV, ii, 439.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13763 !, 38824 !).
Flowers.—September.
Shrub 4 ft. high.
Distribution.—Australia; Timor Island.

428. JATROPHA *L.*

771. **Jatropha gossypifolia** Linn. Sp. Pl. 1006.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13130 !).
Distribution.—Native of Brazil.

772. **Jatropha panduraefolia** Andr. Bot. Rep. t. 267; Woodr. Gard. in Ind. ed. 5, 442.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 15031 !).
Flowers.—May.
Distribution.—Native of Cuba.

429. ALEURITES *FORST.*

773. **Aleurites moluccana** Willd. Sp. Pl. IV, 590.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 13137 !, 12968 !).
Flowers.—April.
Distribution.—India. Native of Pacific Islands.

430. CROTON *L.*

774. **Croton caudatus** Geisel Croton. Mongr. 73.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 38846 !).
Flowers.—August.
Distribution.—Ceylon; Malacca; Java; Philippines. India—E. Himalaya, Assam, Bengal and Silhet to the Deccan.

431. CHROZOPHORA *NECK.*

775. **Chrozophora hierosolymitana** Spreng. Syst. III, 850=verbascifolia.

Locality.—Multan (Monro 206 !); Rawalpindi (Ait. 533 !).
Flowers.—May.
Distribution.—Mediterranean region; Orient.

432. ACALYPHA *L.*

776. **Acalypha ciliata** Forsk. Fl. Aeg. Arab. 162.

Locality.—Rawalpindi (Ait. 168 !, 228 !).
Flowers.—September.
Distribution.—Arabia; Tropical Africa. India—W. Himalaya, alt. 3-6,000 ft., the Deccan Peninsula from the Konkan southwards.

433. SAPIUM *P. Br.*

777. **Sapium sebiferum** Roxb. Fl. Ind. III, 693.

Locality.—Peshawar College (Quizilbash 62 !); Hoshiarpur (Ait. 566 !); Rawalpindi (Ait. 164 !).
Distribution.—Cultivated in various parts of India and elsewhere in warm countries. A native of China.

XCVI. URTICACEAE.

434. TREMA *LOUR.*

778. **Trema politoria** Planch. in Ann. Sc. Nat. Ser. iii, X (1848) 326.

Locality.—Hoshiarpur (Ait. 506 !).
Distribution.—India.

435. CANNABIS *TOURNEF.*

779. **Cannabis sativa** Linn. Sp. Pl. 1027.

Locality.—Rawalpindi (Ait. 230 !).
Flowers.—September.
Distribution.—Central Asia, wild; cultivated in temperate and tropical regions. Throughout India, wild in the N.-W. Himalaya and cultivated elsewhere.

436. Maclura NUTT.

780. **Maclura aurantiaca** Nutt. Gen. Am. II, 234.

Locality.—Changa Manga (Parker 21042 !).
Flowers.—April.
Distribution.—N. America.

437. Morus L.

781. **Morus alba** Linn. Sp. Pl. (1753) 986.

Locality.—Lahore—Changa Manga (Parker 39584 !); Rawalpindi (* Ait. 535 !, 534 !).
Flowers.—March-May. *Fruits.*—Deep purple.
* A cultivated tree in the Punjab proper. On the Hurrow road banks and on Indus banks on rocks it seems indigenous (Ait.).
Distribution.—Afghanistan; N. and W. Asia, wild or cultivated (for its fruit). India—cultivated in the Punjab, N.-W. Himalaya.

782. **Morus indica** Linn. Sp. Pl. 986.

Locality.—Lahore—Race course road (Parker 11413 !, 11451 !, 11414 !).
Flowers.—February-April.
Distribution.—China; Japan. India—temperate and subtropical Himalaya, Bengal, Assam, Burma, wild and cultivated.

783. **Morus laevigata** Wall. Cat. 4649.

Locality.—Rawalpindi—Wate's Garden (Parker 10238 !).
Flowers.—March.
Distribution.—India—tropical and subtropical Himalaya, Indus to Assam and Bihar, wild and cultivated.

438. Ficus L.

784. **Ficus bengalensis** Linn. Hort. Cliff. 471, n. 4.

Locality.—Kalesar, alt. 1,150 ft. (Lace. Herb. 35 !).
Distribution.—Plants in all the plains of India, wild only in the subtropical Himalayan forests and on the lower slopes of the Deccan hills.

785. **Ficus Rumphii** Blume Bijd. 437.

Locality.—Kangra—Shahpur (Parker 10529 !).
Flowers.—May.
Distribution.—Malay Islands. India—on the dry lower slopes of the mountains of the Punjab; N.-W. and C. India, Assam to Burma.

786. **Ficus religiosa** Linn. Hort. Cliff. 471.

Locality.—Hoshiarpur (Ait. 126 !).
Distribution.—Wild in the Sub-Himalayan forests, in Bengal and in Central India; universally planted in India and Ceylon, less frequently in Burma and rarely in the Malay region.

787. **Ficus scandens** Roxb. Fl. Ind. III, 536.

Locality.—Kangra—Shahpur (Parker 10528 !).
Flowers.—March.
Distribution.—Tropical Himalaya from Kumaon eastwards; Assam, Khasia Hills, Chittagong, Burma, and the Andaman Islands; Bihar on Parsunath.

788. **Ficus foveolata** Wall. Cat. 4493.

Locality.—Rawalpindi, Sangseri, 5,000 ft. (Jerram 7602 !).
Flowers.—April.
Distribution.—China. India—Outer Himalaya from Chamba to Bhotan Khasia Hills, Chittagong and Burma.

789. **Ficus palmata** Forsk. Fl. Aegypt. 179.

Locality.—Rawalpindi (Ait. 211); Phagwar, 5,000-6,000 ft. (Jerram 8095!); Peshawar (Stewart!); Gurdaspur, Dhunera (Bisram 306!).
Flowers.—June-September.
Distribution.—N.-W. India from the Indus eastwards to Oudh, ascending to 3,000 ft. in the Himalaya. Westwards to Egypt and Abyssinia.

790. **Ficus Roxburghii** Wall. Cat. 4508.

Locality.—Rawalpindi (Ait. 165).
Distribution.—India—Outer Himalaya, from the Indus to Bhotan, Khasia Hills, Chittagong, Burma, ascending to 5,000 ft.

791. **Ficus glomerata** Roxb. Cor. Pl. II, t. 123 and Fl. Ind. iii, 558.

Flowers.—September.
Distribution.—Outer Himalaya and plains and low hills of India, from Rajputana and the Salt Range to the Khasia Hills, Burma, the Deccan Peninsula, and Ceylon.

792. **Ficus macrophylla** Desf. Tabl. ed. I, 209.

Locality.—Changa Manga (Parker 19341!).
Distribution.—Australia.

439. Artocarpus *FORST.*

793. **Artocarpus integrifolia** Linn. Fl. Suppl. 412.

Locality.—Hoshiarpur (Ait. 476!); Bhullan (Parker 10237!).
Flowers.—January.
Distribution.—Deccan Peninsula, native of the forests of the Western Ghats; cultivated throughout the hotter parts of India and E. Asia.

794. **Artocarpus Lakoocha** Roxb. Fl. Ind. iii, 524.

Locality.—Hoshiarpur (* Ait. 484!).
* Cultivated in Hoshiarpur gardens and does not produce fruit.
Distribution.—Malacca. India—tropical Himalaya, ascending to 4,000 ft. from Kumaon eastwards to Burma and southwards to Travancore.

440. Boehmeria *JACQ.*

795. **Boehmeria platyphylla** Don. Prodr. 60.

Var.—*scabrella* Wedel.
Locality.—Hoshiarpur (Ait. 534!).
Distribution.—India. Ceylon.

441. Pouzolzia *GAUZ.*

796. **Pouzolzia pentandra** Benn. Fl. Jav. 64, t., 14.

Locality.—Rawalpindi (Ait. 190!); Lahore (2987! Brandis' Herb.).
Flowers.—September.
Distribution.—China; Japan. India—tropical Himalaya from Kangra, eastwards to Assam, the Khasia Hills and Bengal, and southwards to Orissa and Canara.

442. Parietaria *TOURNEF.*

797. **Parietaria debilis** Forst. Prodr. 387.

Locality.—Rawalpindi (Ait. 1107!).
Flowers.—May.
Distribution.—Many temperate and tropical regions, extending to Australia and Chili. India—temperate Himalaya, from the Punjab to Sikkim, alt. 8-1,200 ft., the Konkan and Nilgiri Hills.

443. FORSKOHLEA *L.*

798. **Forskohlea tenacissima** Linn. Mant. 72.

Locality.—Rawalpindi, Attock (Ait. 1108 !); Near Peshawar (Collett !).
Flowers.—April.
Distribution.—Egypt; Arabia; Afghanistan. India—W. Punjab, Sind. Baluchistan.

XCVII. PLATANACEAE.

444. PLATANUS *L.*

799. **Platanus orientalis** Linn. Sp. Pl. 999.

Locality.—Rawalpindi, Saidpur (Ait. 1136 !).
Distribution.—Wild from N. Persia westwards to South Italy. India—N.-W. Himalaya; from the Sutlej westwards, cultivated only.

XCVIII. JUGLANDACEAE.

445. ENGELHARDTIA *LESCHEN.*

800. **Engelhardtia Colebrookiana** Lindl. in Wall. Pl. As. Rar. III, 4, t. 208 and Cat. 494.

Locality.—Hoshiarpur (Ait. 529 !).
Distribution.—China. India—W. Himalaya, from the Chenab to Nepal, Assam and the Khasia Hills, Burma.

XCIX. CASUARINACEAE.

446. CASUARINA *FORST.*

801. **Casuarina equisetifolia** Forst. Char. Gen. 103, f. 53.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 14387 !, 14388 !); Ravi Park (Parker 38703 !).
Flowers.—April-June.
Distribution.—Malay Islands; Australia; Pacific. India—On the east of the Bay of Bengal, from Chittagong southwards, cultivated elsewhere in India.

C. SALICACEAE.

447. SALIX *L.*

802. **Salix tetrasperma** Roxb. Cor. Pl. i, 66, t. 97; Fl. Ind. III, 573.

Locality.—Gurdaspur (Bisram 848 !).
Flowers.—May.
Distribution.—Sumatra; Java. Throughout tropical and subtropical India, from the Punjab eastwards to Assam and southwards to Travancore.

803. **Salix acmophylla** Boiss. Diagn. VII, 98; Fl. Orient. IV, 1183.

Locality.—Rawalpindi—Hurroo (Ait. 1113 !).
Flowers.—February.
Distribution.—Afghanistan; Baluchistan and westwards to Syria. N.-W. India.

448. POPULUS *L.*

804. **Populus nigra** Linn. Sp. Pl. 1034.

Locality.—Lombardy (Ait. !).
Cultivated.
Distribution.—Europe.

805. **Populus euphratica** Oliv. Voy. iii, 449, t. 45, 46.

Locality.—Lahore—Islands in the Ravi (Parker 14381 !, 18105 !, 18106 !, 14382 !); (Ait. 110 !).
Flowers.—February. *Fruits.*—September.
Distribution.—W. and C. Asia, and westwards to Syria and Egypt. India—along the Indus Valley, in Sind, the Punjab and planted in the N.-W. Provinces.

CI. GNETACEAE.

449. Ephedra *L.*

806. **Ephedra foliata** Boiss. Fl. Orient V (1881) 716.

Locality.—Rawalpindi (Ait. 536 !); Changa Manga (U. Kangilal !).
Flowers.—May-July.
Distribution.—Afghanistan to Syria. India—Punjab, Rajputana, Sind.

CII. CONIFERAE.

450. Callitris *VENT.*

807. **Callitris quadrivalvis** Vent. Decad. 10.

Locality.—Lahore—Anarkali gdns. (Parker 7515 !, 7516 !, 6046 !).
Flowers.—February-March.
Distribution.—N. Africa.

451. Thuya *L.*

808. **Thuya orientalis** Linn. Sp. Pl. 1002.

Locality.—Hoshiarpur (Ait. 486 !).
Distribution.—China; Japan.

452. Cupressus *L.*

809. **Cupressus lusitanica** Mill. Gard. Dict. ed. VIII, n. 3.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 14386 !, 7518 !).
Flowers.—February.
Distribution.—India. Orient.

453. Pinus *L.*

810. **Pinus longifolia** Roxb. Fl. Ind. iii. 651.

Locality.—Hoshiarpur (Ait. 292 !).
Distribution.—Afghanistan. India—outer Himalayan Ranges, from the Indus to Bhotan.

CIII. CYCADACEAE.

454. Zamia *L.*

811. **Zamia angustifolia** Jacq. Coll. III, 263.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 38859 !).
A stemless tufted Cycad.
Distribution.—Bahama Islands.

CIV. HYDROCHARITACEAE.

455. HYDRILLA *RICHARD.*

812. **Hydrilla verticillata** Casp. in Monatsber. Akad. Berl. 1857.

Locality.—Rawalpindi, Hurroo (Ait. 543 !).
Distribution.—Central Europe; Mauritius; Madagascar; Tropical Asia and Australia. Still and slowly running waters throughout India and Ceylon.

CV. ORCHIDACEAE.

456. EULOPHIA *Br.*

813. **Eulophia campestris** Wall. Cat. 7617.

Locality.—On islands in the river at Urezerabad (Clarke 545 !); Lahore (Stewart 2625 !).
Flowers.—March-May.
Distribution.—Afghanistan. Plains of India, from the Punjab to Oudh, Bengal, Chittagong and the Deccan.

457. ZEUXINE *LINDL.*

814. **Zeuxine sulcata** Lind. Gen. & Sp. Orchid. 485.

Locality.—Hoshiarpur (Ait. 73 !); Lahore (Stewart 2825 !, 2522 !).
Flowers.—March-April.
Distribution.—Afghanistan; Java; China; Philippines. Throughout India in the plains and low hills from the Punjab and Sind to Assam, Chittagong, and southwards to Ceylon.

CVI. HAEMODORACEAE.

458. OPHIOPOGON *KER.*

815. **Ophiopogon japonicus** Ker-Gawl. in Bot. Mag. t. 1063.

Locality.—Rawalpindi 5,000 ft. (Ait. 126 !).
Flowers.—August.
Distribution.—Japan.

CVII. DIOSCOREACEAE.

459. DIOSCOREA *L.*

816. **Dioscorea belophylla** Voigt. Hort. Suburb. Calcutt. 653 (1845), nomen; Haines, For. Fl. Chota-Nagpur 530 decr. = *D. sagittata* Royle.

Locality.—Hoshiarpur (Ait. 586 !).
Distribution.—India.

CVIII. LILIACEAE.

460. SMILAX *L.*

817. **Smilax aspera** Linn. Sp. Pl. 1028.

Locality.—Rawalpindi—Hokraker, 5,000 ft. (Jerram 8066 !, 7790 !, 7789 !).
Fruits.—June.
Distribution.—Ceylon; Syria; S. Europe; N. Africa. Throughout India.

818. **Smilax prolifera** Roxb. Fl. Ind. iii, 795.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 14876 !).
Flowers.—January.
Distribution. Throughout India. Ceylon.

461. Asparagus *L.*

819. **Asparagus capitatus** Baker in Journ. Linn. Soc. XIV, 607.

Locality.—Rawalpindi—Barrakow (Ait. 556 !, 137 !).
Flowers.—April. *Fruits.*—August.
Distribution.—India—foot of the W. Himalaya.

820. **Asparagus racemosus** Willd. Sp. Pl. ii, 152.

Locality.—Hissar bir (Duthie 4450 !).
Distribution.—Tropical Africa; Java; and Australia. Throughout tropical and subtropical India and Ceylon, ascending the Himalaya to 4,000 ft.

821. **Asparagus adscendens** Roxb. Fl. Ind. iii, 153.

Locality.—Hoshiarpur (Ait. 629 !); Rawalpindi (Ait. 235 !, 557 !).
Flowers.—September.
Distribution.—Afghanistan. India—Rohilkhand, the W. Himalaya and the Punjab, from Murree eastwards to Kumaon.

822. **Asparagus Sprengeri** Regal in Act. Hort. Petrop. XI (1890) 490, f. 8,

Locality.—Lahore—Ag. Hort. Gdns. (Parker 14361 !).
Flowers.—April.
Distribution.—S. Africa, Orient.

462. Yucca *DILL.*

823. **Yucca gloriosa** L. Sp. Pl. 319.

Locality.—Lahore (Parker 15044 !).
Distribution.—N. America.

463. Asphodelus *L.*

824. **Asphodelus tenuifolius** Cavan. in Anal. Cienc. Nat. iii, 46, t. 27; and Icon, t. 587, f. 2.

Locality.—Peshawar College (Quizilbash 10 !).
Distribution.—Plains of India, in fields, from Bengal westwards to Gujarat and the Punjab. Westwards to the Canary Islands.

464. Allium *L.*

825. **Allium rubellum** M. Bieb. Fl. Jaur. Cauc. i, 264.

Locality.—Rawalpindi (Ait. 551 !, 550 !, 549 !).
Flowers.—April.
Distribution.—India—Punjab and W. Himalaya, from Kashmir to Kumaon. Westwards to the Ural and Caucasus, and in Siberia.

465. Dipcadi *MEDIC.*

826. **Dipcadi serotinum** Medic. in Act. Palatin. VI, 431.

Locality.—Rawalpindi—Mt. Tilla (Ait. 554 !).
Flowers.—March.
Distribution.—Europe. India—Punjab, Kumaon.

466. Scilla *L.*

827. **Scilla Hohenackeri** Fisch. & Mey. in Bull. Soc. Nat. Masc. 1838, I, 256.

Locality.—Peshawar (Rodger 43399 !); Rawalpindi—Hurroo (Ait. 552 !).
Flowers.—March.
Distribution.—Afghanistan; Persia. India—Punjab.

467. Merendera RAMOND.

828. **Merendera persica** Boiss. & Kotsch. Diagn. XIII, 37; Fl. Orient V, 169.

Locality.—Rawalpindi—Futtehganj (Ait. 1124!).
Flowers.—February-March.
Distribution.—Afghanistan; N. Persia. India—the Punjab.

468. Gloriosa L.

829. **Gloriosa superba** Linn. Sp. Pl. 305.

Locality.—Rawalpindi—Barrakow (Ait. 547!).
Flowers.—September.
Distribution.—Ceylon; Tropical Africa; Malaya; Cochin-China. Throughout tropical India.

CIX. COMMELINACEAE.

469. Commelina L.

830. **Commelina bengalensis** Linn. Sp. Pl. 41.

Locality.—Rawalpindi (Ait. 169!); Multan (* Monro 63!).
Flowers.—September.
* Ointment made from leaves mixed with cotton leaves and butter used for boils.
Distribution.—Tropical Asia and Africa. Throughout India, ascending to 6,000 ft. in the Himalaya.

831. **Commelina glabra** Clarke. Monogr. 163.

Locality.—Rawalpindi (Ait. 170!).
Flowers.—September.
Distribution.—India—the Southern Deccan Peninsula.

CX. PALMAE.

470. Sabal ADANS.

832. **Sabal Adansoni** Guerns. in Bull. Soc. Philom. III (1803) 206, t. 25.

Locality.—Lahore—Ag. Hort. Gdns. (* Parker 13658!).
Flowers.—May.
* Stemless.
Distribution.—N. America.

471. Chamaerops L.

833. **Chamaerops humilis** Linn. Sp. Pl. 1187.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 11450!).
Flowers.—February.
Stem 1-5 ft. high.
Distribution.—W. Mediterranean region.

CXI. TYPHACEAE.

472. Typha L.

834. **Typha elephantina** Roxb. Fl. Ind. iii, 556.

Locality.—Rawalpindi (Ait. 695!).
Flowers.—September.
Distribution.—Algiers. Marshes from N.-W. India to Assam and southwards.

835. **Typha angustata** Chaub. & Bory Exped. Scient. Morée Bot. 338.

Locality.—Multan (4 !); Makhdumpur (Monro 356 !); Rawalpindi (Ait. 694 !); Lahore—Kot Lakhpat (* Parker 14359 !, 14360 !).

Flowers.—September-October.

* Introduced in Kot Lakhpat Plantation by canal water, found in wet Borrow Pits near the canal. Used for making chicks, winnowing trays, etc.

Distribution.—N. Asia and westwards N. Africa and S. Europe. Northern India, from Kashmir to Munnipore and southwards to Sind and Coromandel.

473. Sparganium *L.*

836. **Sparganium ramosum** Huds. Fl. Angl. 40.

Locality.—Rawalpindi (Ait. 540 !).

Flowers.—March.

Distribution.—N. Temp. regions. India.

CXII. ARACEAE.

474. Colocasia *L.*

837. **Colocasia Antiquorum** Schott Melet. I, 18; Syn 40; Prodr. 38.

Locality.—Rawalpindi (Ait. 537 !).

Flowers.—March.

Cultivated for vegetable purposes.

Distribution.—Throughout the hotter parts of India and Ceylon, in moist and dry places, wild or cultivated. Cultivated in all hot countries.

CXIII. LEMNACEAE.

475. Lemna *L.*

838. **Lemna paucicostata** Hegelm. Lemnae. 139, t. 8.

Locality.—Rawalpindi (Ait. 572 !, 538 !).

Distribution.—Cosmopolitan tropical. In various parts of India and Ceylon.

476. Wolffia *HORKEL.*

839. **Wolffia microscopica** Kurz in Journ. Linn. Soc. IX, 265.

Locality.—Lahore (Kashyap 18466 !); Rawalpindi—Futtehgunj (Ait. 539 !).

Distribution.—India.

CXIV. ALISMACEAE.

477. Alisma *L.*

840. **Alisma Plantago** Linn.

Locality.—Hoshiarpur (Ait. 332 !; Bisram 339 !).

Flowers.—June.

Distribution.—N. and S. temperate regions. India—Marshes, etc. of the lower Himalaya, alt. 1-7,000 ft.

CXV. NAIADACEAE.

478. Potamogeton *L.*

841. **Potamogeton perfoliatus** Linn. Sp. Pl. 126.

Locality.—Rawalpindi (Ait. 232 !).

Flowers.—September.

Distribution.—Malay and Sandwich Islands. Throughout the plains of India, ascending the Himalaya to 9,000 ft.

842. **Potamogeton crispus** Linn. Sp. Pl. 126.

Locality.—Rawalpinli (Ait. 569 !).
Distribution.—N. and S. temperate and subtropical regions. Plains of India and temperate Himalaya.

843. **Potamogeton pectinatus** Linn. Sp. Pl. 127.

Locality.—Rawalpindi (Ait. 542 !).
Distribution.—Plains of India. Most regions.

CXVI. CYPERACEAE.

479. CYPERUS *L.*

844. **Cyperus niveus** Retz. Obs. V, 12.

Locality.—Hoshiarpur (Ait. 134 !); Rawalpindi (Ait. 94 !).
Flowers.—July.
Distribution.—Kabul; China. India—from Kashmir to Upper Burma, alt. 0-6,000 ft., Rajputana and southwards to Calcutta and Hyderabad.

845. **Cyperus arenarius** Retz. Obs. IV, 9.

Locality.—Charkhi Dadri in sandy soil (Duthie 4491 !); Rawalpindi (Ait. 239 ! named *C. laevigatus* Koen.).
Flowers.—August-September.
Distribution.—Persia; Arabia; Trop. Asia. India—Rajputana, Sind, Punjab Plains.

846. **Cyperus Atkinsoni** C. B. Clarke in Journ. Linn. Soc. XXI, 109.

Locality.—Charkhi Dadri in sandy soil (Duthie 4491a !).
Flowers.—August.
Distribution.—India.

847. **Cyperus I a** Linn. Sp. Pl. 67. (Excl. Rheede).

Locality.—Rawalpindi (Ait. 129 !).
Flowers.—August.
Distribution.—Old World. India—Rajputana, general in rice fields.

848. **Cyperus eleusinoides** Kunth Enum. ii, 39.

Locality.—Rawalpindi (Ait. 245 !, 244 !).
Flowers.—September.
Distribution.—Asia; Africa; Australia. India—Punjab to Ceylon, Rajputana.

849. **Cyperus tegetum** Roxb. Fl. Ind. i, 208.

Locality.—Hissar (Duthie 4483 !).
Flowers.—August.
Distribution.—Tropical Africa; Mauritius; Ceylon. Throughout India—Rajputana, Sind.

850. **Cyperus rotundus** Linn. Sp. Pl. 67 (not in Linn. Herb).

Locality.—Multan (Monro 340 !, 179 !, 20 !, 18 !); Rawalpindi (Ait. 109 !); Lahore (Stewart 2615 !).
Distribution.—All warm regions. India—Rajputana, Sind, a pestiferous weed.

851. **Cyperus stoloniferus** Retz. Obs. IV, 10.

Locality.—Lahore (Monro 19 !); Multan (Monro 389 !).
Flowers.—September.
Distribution.—Malay Peninsula; Mauritius; China; Malaya; Australia. Shores of India, especially in sea sand, from Sind to Ceylon and Coromandel.

852. **Cyperus serotinus** Rottb. Desc. Nov. Pl. 31; Prog. 18 = *Monti.*

Locality.—Rawalpindi (Ait. 246!).
Flowers.—September.
Distribution.—Europe; Orient.

480. Kyllinga *ROTTB.*

853. **Kyllinga brevifolia** Rottb. Descr. et. Ic. 13, t. 4, f. 3.

Locality.—Rawalpindi (Ait. 240!).
Flowers.—September.
Distribution.—Throughout India, from the Punjab to Assam, Ceylon and Malacca. All warm regions except the Mediterranean.

481. Eleocharis *R. Br.*

854. **Eleocharis palustris** Br. Prodr. 224 (in note).

Locality.—Peshawar (Quizilbash 40!); Rawalpindi (Ait. 558!).
Flowers.—May.
Distribution.—Cosmopolitan. India—from the W. Himalaya to Sind and Bengal.

482. Fimbristylis *VAHL.*

855. **Fimbristylis dichotoma** Vahl. Enum. ii, 287.

Locality.—Muzaffargarh (Monro 270!, 272!).
Flowers.—April.
Distribution.—Warm regions of the Old World. Throughout India—Rajputana, Sind, in rice fields.

856. **Fimbristylis ferruginea** Vahl. Enum. 291.

Locality.—Rawalpindi (Ait. 242!).
Flowers.—September.
Distribution.—All warm regions. Throughout India, Rajputana, Sind, abundant near the sea.

483. Scirpus *L.*

857. **Scirpus quinquefarius** Ham. in Wal. Cat. 3465.

Locality.—Rawalpindi (Ait. 259!).
Flowers.—September.
Distribution.—Turkestan, Afghanistan; Africa. N. India, Rajputana, Sind,

858. **Scirpus mucronatus** Linn. Sp. Pl. 73.

Locality.—Rawalpindi (Ait. 559!).
Flowers.—May.
Distribution.—Europe; Madagascar; warmer Asia; Australia. Throughout India.

859. **Scirpus littoralis** Schrad. Fl. Germ. i, 142, t. 5, f. 7.

Locality.—Rawalpindi (Ait. 560!).
Flowers.—May.
Distribution.—Central Asia; Mediterranean region; Persia; Africa; Ceylon. India—Rajputana, Sind.

484. Carex *L.*

860. **Carex setigera** Don in Trans. Linn. Soc. XIV, 330 & Prodr. 43.

Locality.—Rawalpindi—Murree 6,500 ft. (58!, 55!, 18!).
Flowers.—May.
Distribution.—India.

861. **Carex Wallichiana** Prescott in Wall. Cat. 3380.

Locality.—Rawalpindi—Hurroo (Ait. 1127 !).
Flowers.—March.
Distribution.—Afghanistan. N. India.

CXVII. GRAMINEAE.

485. Paspalum *L.*

862. **Paspalum sanguinale** Lamk. Illustr. I, 176.

Locality.—Rawalpindi (Ait. 120 !).
Flowers.—August.
Distribution.—All warm countries. Throughout India, in dry and moist situations ascending the Himalaya to 6,000 ft.

863. **Paspalum longiflorum** Retz. Obs. IV, 15 (non Trin).

Locality.—Karnal (Drum !).
Flowers.—August-September.
Distribution.—Tropical and subtropical regions of the Old World. Throughout India.

486. Isachne *Br.*

864. **Isachne australis** Br. Prodr. 196.

Locality.—Rawalpindi (Ait. 250 !).
Flowers—September.
Distribution.—Australia; New Zealand. Hotter parts of India, from Assam and Burma to Central India and southwards to Ceylon.

487. Panicum *L.*

865. **Panicum Crus-galli** Linn. Sp. Pl. 56.

Locality.—Karnal (Drum !); Multan !
Flowers.—August.
Distribution.—All warm countries. Throughout India, especially in wet and rich soils.

866. **Panicum colonum** Linn. Syst. Ed. X, 870.

Locality.—Multan (Monro 16; Forest Dept. 8 !); Muzaffargarh (Monro 26 !, 27 !); Rawalpindi (Ait. 96 !); Hissar bir (Duthie 5026 !).
Flowers.—July-September.
Best fodder for cows, buffaloes, horses. The seed is eaten by people. Hindus make sweetmeat of it during fast days.
Distribution.—All warm countries. Throughout India and Ceylon.

867. **Panicum prostratum** Lamk. Illustr. i, 171; Encycl. IV, 745.

Locality.—Rawalpindi (Ait. 107 !).
Flowers.—July.
A good fodder grass.
Distribution.—Tropics generally. Plains of India from the Punjab, Sind to Assam and Burma and southwards to Ceylon.

868. **Panicum ramosum** Linn. Mant. i, 29.

Locality.—Hissar (Duthie 5019 !) Karnal (Drum !); Hansee 187 !; Multan (Monro 369 !; * Forest Dept. 2 !).
Flowers.—August.
* Grows on sandy soil with enough moisture. Good fodder for cattle, worse fodder for camels and goats.
Distribution.—Afghanistan; Ceylon. Plains of India from Sind, Rajputana and the N.-W. Provinces to Bihar and southwards to Madras.

869. **Panicum hydaspicum** Edgew. in Journ. Linn. Soc. vi (1862) 207.

Locality.—Karnal jungle (Drum !); Rawalpindi (Ait. 123 !).
Flowers.—August-September.
Distribution.—India—the Punjab and Upper Gangetic Plain.

870. **Panicum antidotale** Retz Obs. IV, 17.

Locality.—Hissar bir (Harsukh 20715 !, Duthie 5025 !); Multan (Monro 81 !; Duthie 10802 !); Rawalpindi (Ait. 113 !); Hoshiarpur (Ait. 1114 !).
Flowers.—July-February
Distribution.—Afghanistan; Africa; Tropical Australia. India—the Punjab, Rajputana, Sind, Upper Gangetic Plain and southwards to S. Deccan and Ceylon.

488. Oplismenus *BEAUV.*

871. **Oplismenus compositus** Beauv. Agrost. 54.

Locality.—Hooshiarpore (Ait. 480 !).
Distribution.—Ceylon, most tropical regions (except Australia). Throughout India.

489. Setaria *BEAUV.*

872. **Setaria glauca** Beauv. Agrost. 51.

Locality.—Karnal (Durm !); Rawalpindi (Ait. 108 !).
Flowers.—May-July.
Distribution.—All warm, temperate and tropical regions. Throughout India, especially in cultivated ground.

490. Pennisetum *PERS.*

873. **Pennisetum orientale** Rich. in Pers. Syn. i, 72.

Locality.—Rawalpindi—Murree (Wingate 35 !); Barrakow 2,500 ft. (Wingate 4 !).
Flowers.—April-May.
Distribution.—Asia Minor and N. Africa. India—W. Himalaya, the Punjab, Sind, the Konkan and Bihar.

874. **Pennisetum cenchroides** Rich. in Pers. Syn. i, 72.

Locality.—Multan (Monro 14 !, 13 !; * Forest Dept. 14 !); Lahore (Stewart 2524 !; Duthie !; Brandis' Herb. 2960 !); Rawalpindi (Ait. 99 !).
Flowers.—August-September.
* Best fodder to increase milk for cattle. Average kind of fodder for ponies. Grows on good sandy and moist soils.
Distribution.—Canary Islands; Tropical Africa; Sicily. India—plains and low hills throughout W. India, Rajputana, Sind. Baluchistan.

875. **Pennisetum Prieurii** Kunth Revis. Gram. ii, 411, t. 119; Enum. Pl. i, 162; Suppl. 119.

Locality.—Lahore (Hein !); Multan (Monro 14 !).
Flowers.—August-September.
Distribution.—Tropical Africa. India—The Punjab, Rajputana.

876. **Pennisetum typhoideum** Rich. in Pers. Syn. I (1805) 72.

Locality.—Lahore (Stewart 2844 !).
Distribution.—Africa and S. Europe. Throughout the hotter parts of India, widely cultivated.

491. CENCHRUS *L.*

877. **Cenchrus biflorus** Roxb. Fl. Ind. i, 233.

Locality.—Lahore (2957; Stewart 2845!); Hissar bir (Harsukh 20708!; Duthie 5034!); Sialkot (Bairus' father!).
Flowers.—April-October.
Distribution.—Arabia; Africa. India—the Punjab, Rajputana, Sind, Upper Gangetic Plain, the Konkan. Baluchistan.

878. **Cenchrus catharticus** Delile Cat. Hort. Monsp. 1838; in Linnaea XIII (1839) Litterb 103.

Locality.—Hissar bir (Harsukh 20702!); Panipat (Drum!).
Flowers.—October.
Distribution.—Arabia; Tropical Africa. India—the Punjab, Rajputana, Upper Gangteic Plains.

492. ORYZA *L.*

879. **Oryza sativa** Linn. Sp. Pl. 333.

Locality.—Rawalpindi (Ait. 255!).
Fruits.—September.
Distribution.—Ceylon; Tropical Australia. Indigenous in marshes of Rajputana, Sikkim, Bengal, the Khasia Hills, Central India, the Circars.

493. TRAGUS *HALLER.*

880. **Tragus racemosus** Scop. Introd. Hist. Nat. 73.

Locality.—Rawalpindi (Ait. 110!); (Barrakow 1!).
Flowers.—May-August.
Distribution.—Warm regions generally. Dry plains of India, Burma, Ceylon.

494. IMPERATA *CYRILL.*

881. **Imperata arundinacea** Cyrill. Pl. Rar. Neap Fasc. ii, 26, t. 11.

Locality.—Rawalpindi—Barrakow (Ait. 568!, 94!).
Flowers.—April-September.
Distribution.—Hotter parts of India, from the Punjab southwards, and eastwards to Malacca and Ceylon.

495. SACCHARUM *L.*

882. **Saccharum spontaneum** Linn. Mant. ii, 183.

Locality.—Multan (Monro 34!); Rawalpindi (Ait. 131!).
Flowers.—September-October.
Distribution.—S. Europe and warm regions of the Old World; E. Australia. Throughout the warmer parts of India and Ceylon, ascending to 6,000 ft., in the Himalaya.

883. **Saccharum arundinaceum** Retz. Obs. IV, 14.

Locality.—Multan (Monro 33!); Karnal Gdns (3006! Drum's Herb).
Flowers.—October.
Distribution.—Ceylon; China. Throughout the plains and low hills of India.

496. ERIANTHUS *MICHX.*

884. **Erianthus Ravennae** Beauv. Agrost. 14.

Locality.—Karnal (Jabraya 3008! Drum's Herb); Lahore (For. Economist 20162!, 20163!).
Flowers.—October-December.

Distribution.—India—W. Himalaya, from Kashmir to Kumaon, the Punjab and Upper Gangetic Plain, from the Indus to Delhi. Westwards to the Mediterranean.

497. ISCHAEMUM *L.*

885. **Ischaemum angustifolium** Hook. Monogr. Androp. 241.

Locality.—Rawalpindi—Barrakow (Ait. 563 !).
Flowers.—April.
Distribution.—Afghanistan ; China ; Philippines. India—Lower Himalaya, the Punjab, Rajputana, Mt. Aboo, the Satpura Hills, Bihar on Parusnath, Central India.

498. POGONATHERUM *BEAUV.*

886. **Pogonatherum saccharoideum** Beauv. Agrost. 56, t, f. 7.

Locality.—Hoshiarpur (Ait. 542 !).
Distribution.—China ; Malaya. Throughout the hilly parts of India, in dry places, from the Punjab eastwards to Bhotan, Manipur, Burma, ascending the Himalaya to 4,000 ft. and southwards to Central India and Ceylon.

499. ROTTBOELLIA *L.* f.

887. **Rottboellia compressa** Linn. f. Suppl. 114.

Locality.—Multan (Monro 209 !).
Distribution.—Throughout the hotter parts of India, generally in wet places, Burma and Ceylon. Westwards to Spain and the Canaries and in most warm climates.

888. **Rottboellia compressa** Linn.—var. *fasciculata* Hack.

Locality.—Rawalpindi (Ait. 252 !) ; Lahore (For. Dept. 6 !).
Flowers.—September.
Distribution.—India—common especially on the borders of pools, often climbing among bushes.

889. **Rottboellia perforata** Roxb. Pl. Corom. ii, 43, t. 182 ; Fl. Ind. I, 356.

Locality.—Rawalpindi (Ait. 122 !).
Flowers.—July.
Distribution.—Afghanistan ; Java. Throughout India from the Indus to Burma and southwards to Ceylon.

500. ELIONURUS *HUMB. & BONPL.*

890. **Elionurus hirsutus** Munro ex Benth. in Journ. Linn. Soc. XIX (1881) 68.

Locality.—Hissar bir (Harsukh 20700 ! ; Duthie 5053 !) ; Rawalpindi (Wingate !) ; Multan (Monro !).
Flowers.—April-November.
Distribution.—India—N. Punjab, Rajputana, Sind. Westwards to N. Africa.

501. ANDROPOGON *L.*

891. **Andropogon foveolatus** Del. Fl. Egypt. 16 a, t. 8, f. 2.

Locality.—Hissar bir (Duthie 5064 !) ; Rawalpindi (Ait. 98 !).
Flowers.—August.
Distribution.—Drier parts of India, from the Punjab and Sind to Bengal, Chota Nagpur, Central Provinces, Circars, and Coromandel. Baluchistan ; westwards to the Cape Verde Islands.

892. **Andropogon Ischaemum** Linn. Sp. Pl. 1047.

Locality.—Hissar bir (Duthie 5060 !); Rawalpindi (Ait. 93 !).
Flowers.—August.
Distribution.—N.-W. India. Westwards to S. Europe, and tropics generally or sporadically.

893. **Andropogon halipensis** Brot. Fl. Lusit, i. 89.

Locality.—Lahore (Monro 24 !); Rawalpindi (Ait. 116 !).
Flowers.—August.
Distribution.—Most warm countries. Throughout India, Burma and Ceylon in open places.

894. **Andropogon squarrosus** Linn. f. Suppl. 433. (*A. vetiverica zizanoides* Stapf.).

Locality.—Rawalpindi (Ait. 142 !); Peshawar (Stewart !); Hissar bir (Duthie 5061 !); Muzaffargarh (Monro 28 !).
Flowers.—August-September.
Distribution.—Java; Tropical Africa. Throughout the plains and lower hills of India, Burma and Ceylon.

895. **Andropogon monticolus** Schult. Mant. iii, 665.

Locality.—Rawalpindi (Wingate !).
Flowers.—April.
Distribution.—Burma; Afghanistan; S. Africa. India—W. Himalaya, from the Punjab to Bihar and southwards to Ceylon.

896. **Andropogon monticola** Schult. var. *Trinii.*

Locality.—Rawalpindi (3 !, 7 !, Ait. 92 !).
Flowers.—May-August.

897. **Andropogon annulatus** Forsk. Fl. Aeg. Arab. 173.

Locality.—Hissar bir (Duthie 5063 !, 5063 a !); Multan (Monro 22 !).
Flowers.—August-September.
Distribution.—Tropical Africa; China; Australia; Pacific Islands. Throughout the hills and plains of India.

898. **Andropogon contortus** Linn. Sp. Pl. 1045.

Locality.—Hissar bir (Duthie 5058 !); Rawalpindi (Ait. 117 !).
Flowers.—August.
Distribution.—Mediterranean region and tropics generally. Throughout India, Burma and Ceylon.

899. **Andropogon Iwarancusa** Jones in Asiat. Research IV (1795) 109. = Cymbopogon Iwarancusa Schult. fide Stapf.

Locality.—Hissar bir (Duthie 5062 !); Lahore (Stewart 2600 !; Brandis Herb. 2922 !); Multan (* For. Dept. 17 !; Duthie 10796 !).
Flowers.—April-December.
*Grows in good sandy soil. Its flowers have got a nice smell and are used to make native scent. Average sort of fodder for cattle. Its roots are perhaps used as Khas for Tatties.
Distribution.—Plains of N.-W. India, Sind, W. Himalaya, N, Canara and the Deccan. Westwards to N. Africa.

900. **Andropogon Iwarancusa** Jones in Asiat. Research. IV (1795) 109. var. *laniger* Desf. Fl. Atlant. ii, 379 = *Cymbopogon Schoenanthus* Spreng. fide Stapf.

Locality.—Rawalpindi.—Barrakow (Ait. 562 !); Multan (Monro 2 !); Hissar bir (Duthie 5062 !; Harsukh 20705 !).
Flowers.—April-September.

Distribution.—Plains of N.-W. India, Sind, W. Himalaya, N. Canara and the Deccan. Westwards to N. Africa

901. **Andropogon Schoenanthus** Linn. Sp. Pl. 1046.

Locality.—Hissar bir (Harsukh 20709 !); Patiala State (35 !).
Flowers.—October.
Distribution.—Hotter parts of India, wild or cultivated from the Punjab to Burma, and southwards to Travancore and Ceylon. Westwards to Tropical Africa.

502. Iseilema *HACK.*

902. **Iseilema Wightii** Anders. in Nov. Act. Soc. Sc. Upsal. Ser. 3, ii, 251.

Locality.—Hissar bir (Harsukh 20706 !, Duthie 5076 !); Sialkot (Bairu's father !); Lahore (For. Dept. 16 !).
Flowers.—August-October.
Distribution.—Throughout India.

503. Apluda *L.*

903. **Apluda varia** Hack. Mongr. Androp. 196. var. *aristata.*

Locality.—Rawalpindi (Ait. 257 !); Lahore (For Dept. 16 !); Karnal (Drum !).
Flowers.—May-September.
Distribution.—E. Tropical Asia, Malaya; Australia; Pacific Islands. Throughout India.

504. Phalaris *L.*

904. **Phalaris minor** Retz. Obs. iii, 8.

Locality.—Lahore (Stewart 2525 !).
Distribution.—Plains of W. India and the Himalaya. Westwards to Canaries; S. Africa; Australia.

505. Aristida *L.*

905. **Aristida Adscenscionis** Linn. Sp. Pl. 82.

Locality.—Hissar (Duthie 5078 !; Harsukh 20701 !); Rawalpindi (Ait. 95 !).
Flowers.—July-October.
Distribution.—Baluchistan and most warm countries. Throughout the plains and low hills of India, Burma and Ceylon.

906. **Aristida Hystrix** Linn. f. Suppl. 113.

Locality.—Rawalpindi (Ait. 118); Hissar bir (Duthie 5079 !).
Flowers.—August.
Distribution.—India—the Deccan Peninsula, from the Konkan and Central Provinces southwards.

907. **Aristida funiculata** Trin. & Rupr. in Mem. Acad. Petersb. Ser. VI, vii (1849) 159.

Locality.—Multan (Ram Nath 50481 ! ; 50480 !, 50479 !).
Distribution.—Arabia; Tropical Africa. India—Punjab plains, Rajputana, Sind, and the Konkan. Baluchistan.

908. **Aristida hystricula** Edgew. in Journ. Linn. Soc. VI (1862) 208.

Localtiy.—Hissar bir (Harsukh 20712 !).
Flowers.—October.
Distribution.—India—Punjab, Sind. Baluchistan.

909. **Aristida hirtigluma** Steud. Nom. Ed. II, ii, 231, Syn. Gram. 144.

Locality.—Muzaffargarh (Monro 304 !).
Flowers.—April.
Distribution.—Westwards to Egypt and Abyssinia. India—the Punjab. Sind.

506. STIPA *L.*

910. **Stipa orientalis** Trin. ex. Ledeb. Fl. Alt. i, 83.

Locality.—Peshawar (* Stewart !).
* Not common.
Distribution.—W. Tibet, westwards to Persia, Altai Mts.

507. ALOPECURUS *L.*

911. **Alopecurus nepalensis** Trin. ex Steud. Syn. Gram. 148.

Locality.—Rawalpindi (Wingate !).
Distribution.—India—the Punjab, Upper Gangetic Plains, Gharwal.

508. POLYPOGON *DESF.*

912. **Polypogon monspeliensis** Desf. Fl. Atlant. i, 66.

Locality.—Hoshiarpur (Ait. 626 !); Lahore (Brandis Herb. 2921 !).
Distribution.—Ceylon. Tropical and temperate regions. Throughout continental India.

509. SPOROBOLUS *Br.*

913. **Sporobolus diander** Beauv. Agrost. 25.

Locality.—Multan (Monro 6 !).
Flowers.—September-November.
Distribution.—Asia and Tropical Australia. Throughout India, Burma and Ceylon.

914. **Sporobolus indicus** Br. Prodr. 170.

Locality.—Rawalpindi (Wingate !).
Flowers.—April.
Distribution.—All warm countries. Throughout India, Burma and Ceylon.

915. **Sporobolus minutiflorus** Link. Enum. Hort. Berol. i, 88.

Locality.—Hissar (Duthie 5083 !).
Flowers.—August.
Distribution.—India—Deccan Peninsula, Canara.

916. **Sporobolus glaucifolius** Hochst. in Flora, XXV (1842) I, Bieb. 123.

Locality.—Multan (Monro 11 !, 364 !, 12 !; Duthie 1080 !; *For. Dept. 10 !); Hissar bir—damp ground (Duthie 5085 !).
Flowers.—September-December.
* On good sandy soil. Easily killed by deposit of silt. Best fodder for cows, buffaloes and horses. Makes good hay.
Distribution.—Tropical Africa. India—the Punjab, Sind.

917. **Sporobolus arabicus** Boiss. Diagn. Pl. Or. Ser. I, XIII, 47.

Locality.—Multan (Monro 12 !, 3 !, 48 !; Duthie 10804 !); Rawalpindi (Ait. 249 !); Hissar (Duthie 5082 !, 5084 !).
Flowers.—August-December.
Distribution.—Arabia; Baluchistan; Waziristan. India—Punjab plains, Sind, Rajputana.

918. **Sporobolus coromandelianus** Kunth Revis. Gram. I, 681, Enum. Pl. 213

Locality.—Multan (Monro 5 !).
Flowers.—September.
Distribution.—Afghanistan. N. and S. Africa. Plains of India from the Punjab eastwards to Burma and southwards to Ceylon.

510. AGROSTIS *L.*

919. **Agrostis alba** Linn. Sp. Pl. 63.

Locality.—Rawalpindi (Ait. 571 !).
Flowers.—May.
Distribution.—N. temperate regions. India—W. Himalaya.

511. AVENA *L.*

920. **Avena fatua** Linn. Sp. Pl. 80.

Locality.—Lahore (Stewart 2677 !); Rawalpindi (Ait. 569 !).
Flowers.—May.
Distribution.—Temperate Europe; N. Africa; N. Asia. India—the Punjab, N.-W. Himalaya, in cultivated fields.

512. GRACILEA *KOEN.*

921. **Gracilea Royleana** Hook. f. in Fl. B. I. VII (1896) 284.

Locality.—Hissar bir (Harsukh 20707 !; Duthie 5096 !).
Flowers.—October.
Distribution.—Socotra; Nubia. India—the Punjab plains, Rajputana, Sind, Central India, Konkan, Canara.

513. CYNODON *PERS.*

922. **Cynodon dactylon** Pers. Syn. i, 85.

Locality.—Multan (Monro 1 !); Rawalpindi (Ait. 119 !); Muzaffargarh (Monro 238 !).
Flowers.—August-September.
Distribution.—All warm countries. Throughout India, Burma and Ceylon, ascending to 5,000 ft., in the Himalaya. Baluchistan.

514. CHLORIS *Sw.*

923. **Chloris tenella** Roxb. Fl. Ind. i, 329.

Locality.—Hissar (Coldstream !).
Flowers.—October.
Distribution.—Arabia; Abyssinia. India—Rajputana, Sind, Oodeypur, Khandesh, S. India.

924. **Chloris villosa** Pers. Syn. i, 87.

Locality.—Rawalpindi (Ait. 100 !).
Flowers.—July.
Distribution.—India—the Punjab, Rajputana, Sind, Oodaypore. Baluchistan; westwards to the Canaries.

515. ELEUSINE *GAERTN.*

925. **Eleusine flagellifera** Nees. in Linnaea XVI (1842) 220.

Locality.—Multan (Monro 21 !; For. Dept. 12 !; Duthie 805 !); Hissar (Harsukh 20710 !; Duthie 5099 !); Lahore (Duthie !; For. Dept. 5 !); Hansee (187 !).
Flowers.—April-December.

Distribution.—Afghanistan; N. Africa. India—the Punjab plains, Rajputana, Sind. Baluchistan.

926. **Eleusine verticillata** Roxb. Fl. Ind. i, 346.

Locality.—Hissar bir (Harsukh 70703!; Duthie 5098!); Hansee (187!), Rawalpindi (Ait. 121!); Multan (Monro 4!).
Flowers.—August-October.
Distribution.—Tropical Asia; Africa and Australia. Plains of India.

927. **Eleusine aegyptiaca** Desf. Fl. Atlant. i, 85.

Locality.—Hissar bir (Duthie 5101!; Harsukh 20713!); Rawalpindi (Ait. 105!); Multan (Monro 3!).
Flowers.—August-October.
Distribution.—India—Rajputana, Sind. Burma; Ceylon; warm regions of the Old World; introduced into the New.

516. LEPTOCHLOA *BEAUV.*

928. **Leptochloa filiformis** Roem. & Sch. Syst. ii, 580.

Locality.—Rawalpindi (Ait. 253!).
Flowers.—September.
Distribution.—Ceylon; Tropical Asia; Africa; and America. Throughout India and Burma in the low country.

517. PAPPOPHORUM *NEES.*

929. **Pappophorum Aucheri** Jaub. & Spach. Ill. Pl. Orient. IV, 32, t. 323.

Locality.—Rawalpindi (Ait. 112!, Wingate!).
Flowers.—April-July.
Distribution.—Afghanistan; Persia; Turkistan. India—W. Punjab.

518. ARUNDO *L.*

930. **Arundo Donax** Linn. Sp. Pl. 81.

Locality.—Rawalpindi (Ait. 1135!).
Flowers.—February.
Distribution.—India—lower Himalaya and from the Punjab to Silhet, Naga Hills, Burma, the Circars, Nilgiri and Coorg Hills. Westwards to Europe; N. Africa; N. Asia.

519. PHRAGMITES *TRIN.*

931. **Phragmites communis** Trin. Fund. Agrost. 134.

Locality.—Rawalpindi (Ait. 258!, 256!).
Flowers.—September.
Distribution.—N. and S. temperate regions. India.

932. **Phragmites Karka** Trin. ex. Steud. Nom. Ed. ii, 324.

Locality.—Multan (Monro 40!, 354!); Rawalpindi (Ait. 258!).
Flowers.—September-October.
Distribution.—Afghanistan; Japan; Tropical Asia; Africa and Australia. Throughout India, from the Punjab to Burma and southwards to Ceylon.

520. ERAGROSTIS *BEAUV.*

933. **Eragrostis interrupta** Beauv. Agrost. 71 (non Roem. & Sch. nec. Trin.).

Locality.—Hissar bir (Harsukh 20714!; Duthie!); Multan (Monro 10!, 42!; For. Dept. 20!); Lahore (Monro 23!; For. Dept. 20!).
Flowers.—August-January.
* Average kind of fodder for cows and buffaloes only.

Distribution.—Mesopotamia; Tropical Africa. Throughout India, Burma and Ceylon.

934. **Eragrostis tremula** Hochst. ex Steud. Syn. Gram. 269.

Locality.—Multan (* For. Dept. 4!); Hissar bir (Duthie 5510!); Lahore—(For. Dept. 17!); Multan (Monro 231!, 390!).
Flowers.—May-August.
* Worse fodder for cattle.
Distribution.—Afghanistan; Tropical Africa. Northern India from the Punjab to Bengal and Burma and southwards to Carnatic.

935. **Eragrostis major** Host. Gram. Austr. IV, 14, t. 24.

Locality.—Hissar bir (Harsukh 20704!).
Flowers.—October.
Distribution.—Throughout the plains and lower hills of India and Burma, ascending to 5,000 ft. in the Himalaya. Ceylon; Westwards to S. Europe; Tropical and subtropical Asia.

936 **Eragrostis minor** Host. Gram. Austr. IV, 15, Fl. Austr. i, 135.

Locality.—Rawalpindi (Ait. 104!); Lahore (Cleghorn 2640!).
Flowers.—July.
Distribution.—Plains of N. India from the Punjab eastwards to Bengal, ascending the Himalaya to 8,000 ft., Sind, Rajputana, Konkan. Westwards to S. Europe and N. Asia.

937. **Eragrostis pilosa** Beauv. Agrost. 71.

Locality.—Hissar bir (Harsukh 20716!; Duthie 5109!); Multan (* For. Dept. 28!); Rawalpindi (Ait. 106!, 115!, 101!).
Flowers.—July-October.
* Average kind of fodder for cattle.
Distribution.—Ceylon; S. Europe; and most warm countries. Throughout India and Burma, ascending the Himalaya to 5,000 ft. or more.

938. **Eragrostis cynosuroides** Beauv. Agrost. 71, 162.

Locality.—Rawalpindi (Ait. 103!); Multan (* For. Dept. 18!; Monro 91!); Hissar bir (Duthie 5108!).
Flowers.—July-September.
* The roots of this as well as those of *Saccharum spontaneum* are used by Syces to enlarge their bundles of grasses.

521. AELUROPUS *TRIN.*

939. **Aeluropus villosus** Trin. ex C.A. Mey. Verz. Pfl. Cauc. 18.

Locality.—Multan—on saline soil (Ram Nath 49456!; Duthie 10798!; *For Dept. 7!; Monro 277!, 236!).
Flowers.—July-December.
* Good fodder.
Distribution.—Ceylon, Mediterranean region; Caspian Sea; Arabia; Persia; Afghanistan. India—Salt plains of the Punjab and Sind, sandy shores of the Deccan Peninsula.

522. POA *L.*

940. **Poa annua** Linn Sp. Pl. 68.

Locality.—Rawalpindi (Ait. 569!); Lahore (Stewart 2664!).
Flowers.—July.
Distribution.—Ceylon; Europe; Temperate Asia. India—throughout the temperate and subalpine Himalaya, the Khasia and Nilgiri Hills.

523. BROMUS *L.*

941. **Bromus tectorum** Linn. Sp. Pl. 77.

Locality.—Rawalpindi (Wingate !).
Flowers.—April.
Distribution.—Europe; N. Africa; N. and W. Asia. India—W. Himalaya from Gilgit to Kumaon.

524. LOLIUM *L.*

942. **Lolium temulentum** Linn. Sp. Pl. 83.

Locality.—Lahore (Stewart 2665 !).
Flowers.—March.
Distribution.—Europe; N. Asia. India—Upper Gangetic Plain, Punjab, Sind, and W. Himalaya.

525. OROPETIUM *TRIN.*

943. **Oropetium Thomaeum** Trin. Fund. Agrost 98, t. 3.

Locality.—Hissar bir (Harsukh 20711 !; Duthie 5123 !).
Flowers.—August-October.
Distribution.—Plains of India, from the Punjab to Bengal, Burma and southwards in the western Peninsula.

944. **Oropetium biflorus** Stapf.

Locaity.—Hissar (Drum ! 3002 !).

526. TRITICUM *L.*

945. **Triticum vulgare** Vill. Hist. Pl. Dauph. II, 153.

Locality.—Lahore (Stewart 2523 !).
Distribution.—India—cultivated in many parts of N. India and the Deccan Peninsula, especially in the N.-W. and upto 13,000 ft. in the Himalaya.

527. BAMBUSA *SCHREB.*

946. **Bambusa nana** Roxb. Fl. Ind. II, 190.

Locality.—Lahore—Ag. Hort. Gdns. (Parker 38646 !).
Flowers.—May.
Distribution.—Cultivated in Ceylon and many parts of India. Malay Peninsula; Native of China and Japan.

CRYPTOGAMIA.

FILICES.

528. ADIANTUM *L.*

947. **Adiantum capillus Veneris** L. The true Maiden Hair Fern.

Locality.—Rawalpindi (Ait. 236 !).
Flowers.—September.
Distribution.—Europe; Africa; America; Australia; common in gardens. India—Bombay Presidency; Madras Presidency, westside; common on banks of rivers in the plains and upto 5,000 ft.; N. India.

529. PTERIS *L.*

948. **Pteris longifolia** L.

Locality.—Rawalpindi (Ait. 237 !).
Sori—September.
Distribution.—India—throughout Bombay and Madras Presidencies, Bengal in the Plains and upto 50,000 ft. Burma; Ceylon; widely distributed over the whole world.

FURTHER OBSERVATIONS ON THE FLYING-FOX (*PTEROPUS GIGANTEUS* BRÜNN.) AND THE FULVOUS FRUIT-BAT (*ROUSETTUS LESCHENAULTI* DESM.).

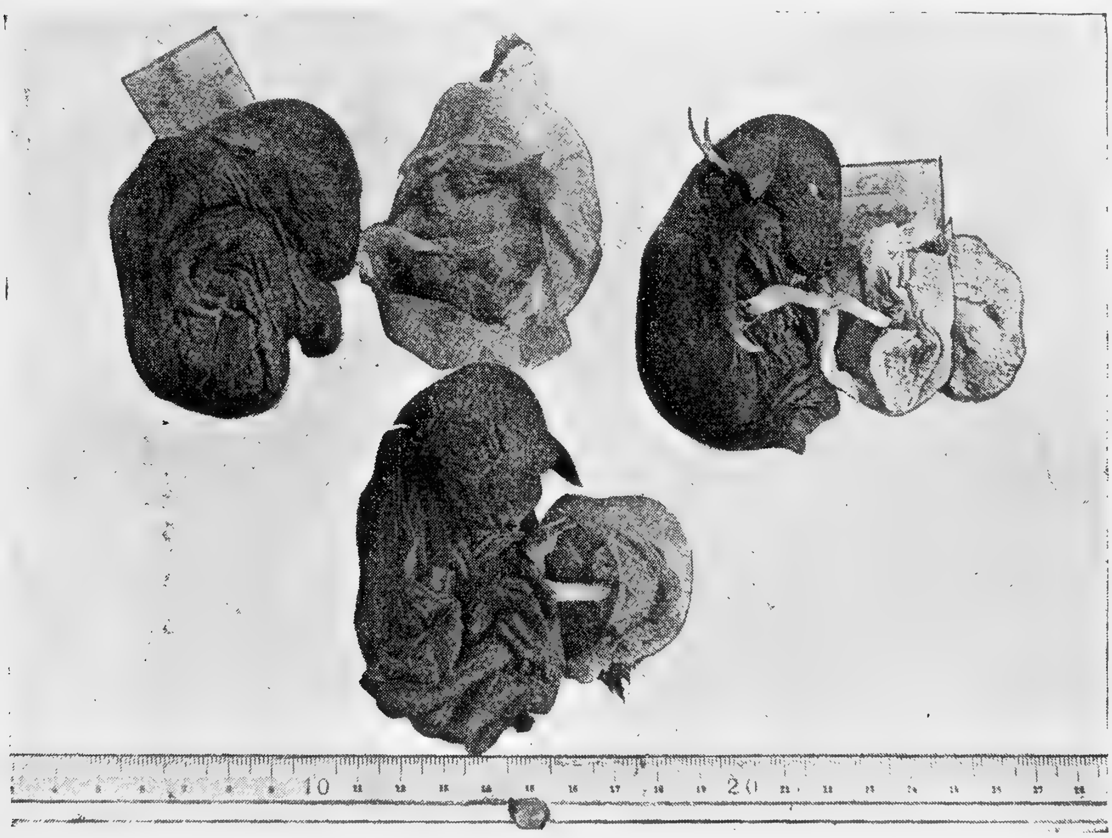
BY

CHARLES McCANN, F.L.S.

(*With* 1 *photo and* 1 *text-figure*).

In volume xxxvii, p. 143, of the Society's *Journal*, I dealt with some of the phases in the life-history of the Flying-Fox (*P. giganteus*); but animal life-histories are rarely, if at all, exhaustive, and my observations were far from complete. I now add a few more links to the chain.

On the 25th January (1941) I witnessed a couple in copulation at the Victoria Gardens roost, Byculla, at about 4 p.m. One approached the other from a neighbouring branch, as soon as the ventral surfaces were juxtaposed copulation ensued. The wings took no part in the hold. There was some squeeling, the act was brief, and the pair separated.



Foetuses of the Flying-Fox (*P. giganteus*). The top specimen on the left shows the correct position.

On the night of the 22nd February I shot some Flying-Foxes visiting the flowers of the Silk Cotton Tree (*Bombax Ceiba* L.) at Andheri. Among them were two gravid females, each containing a single foetus. At a rough estimate I would suggest that these two foetal specimens were about two weeks from full time. The skin was deeply pigmented and had a coating of short hair. This

clearly indicated that the young are not born naked. On the 26th (February) I secured another foetus of about the same age. The foetal specimens were large; measured within the foetal membranes they were approximately 76 x 54 mm. The back and neck were strongly arched and the long axis of the head was almost parallel with that of the back. The 'wrists' of both the wings rest on the neck just behind the right ear. The forearms pass obliquely across the body to the lower left side, one 'elbow' being hidden in the folds of the lower membranes; the other, the left, being exposed a little below the snout. The pollex or 'thumb' of the left wing is exposed below the toes, the other is hidden. The chin rests in the V formed by the forearm and the upper arm (humerus) of the left wing. The feet are gathered up, the right being hidden under the membranes of the wings. The left foot lies exposed on the right side, partially over the left forearm. The knee of the right leg is prominent, but the left is hidden from view. The ear of the right side is folded backwards; the left forwards. The umbilical cord passes out at the bottom of the V formed by the fore- and upper-arm. A comparison of the foetuses of the Flying-Fox and the Fulvous Fruit-Bat (*R. leschenaulti*) show that the position of the foetus of these two bats within the foetal investments is totally different. A short description of the position of the foetus of *Rousettus* will be found in my article on the Fulvous Fruit-Bats (*Journ. Bomb. Nat. Hist. Soc.* vol. xli, p. 813.).

On the 27th February, my son, Carl., found an adult *Pteropus* electrocuted on the mains. He got it down and to his surprise found a recently born young one clinging to the putrifying body of its mother. It was still alive and apparently uninjured. On examination I found the umbilical cord still adhering, but quite dry. The little fellow called frequently, a quaint, though loud call, quite unlike anything I have heard the adults produce. Though it baffles description, the call may be likened to the noise made by rapidly twisting a glass stopper in the neck of a bottle! My boys were anxious to try and rear it, so I allowed them the pleasure. Four days later the cord dropped off. The young bat fed on milk administered through a pipette and appeared to be thriving, but it died on the 5th March. On the day of its capture, its wing-span measured 450 mm.; the fore-arm 72 mm.

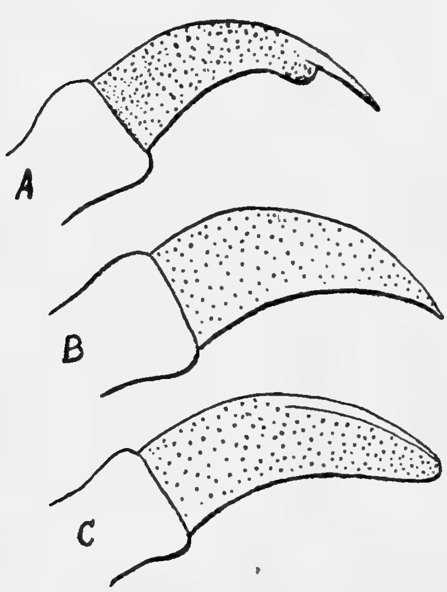


Fig. 1.—A. Claw of newly-born young,
B. ,, adult
C. ,, foetus.

While handling the little creature I noticed that the claws were extremely sharp and that they punctured the skin very readily. I examined the claws with a strong lens and soon discovered the reason for this. The claws were deep brown except the tips which were almost white and provided with extremely fine-pointed cusps. For the sake of comparison, I examined the claws of adults. The

claws were sharply pointed, but the cusps were entirely absent (see figures). The cusps in the young undoubtedly serve as a means of securing a firm hold on the body of the parent. The general tone of the fur was darker than in the adults; the wings and other naked portions of the body were a deep brown. The eyes were black and beady. The large size of the feet was remarkable. A peculiar odour hung about the animal. It clung well to branches and wire mesh, and there was little danger of it ever falling. It never moved about much, but when it was in difficulties it began to squeel.

These observations confirm my suggestion that the majority of births occur in March. The high birth rate at that time of the year in our area coincided with the greatest food supply for the parents, for it is the time when most trees are in bloom, a suitable period for nectar feeding animals. All males shot at this period clearly indicated that the breeding season was over as the testes were in a quiescent condition, and were not at all visible externally. During the breeding season the organs are pronounced.

In the breeding season one would expect the animals to be in the pink of condition, both internally and externally, but this does not always appear to be the case. One of the females, containing a well-developed foetus, was partially naked. The entire head and the greater part of the body were completely devoid of fur. The naked skin was a polished blackish brown, but to me, showed no signs of disease. In spite of this outward defect, she was well provided with fat internally. The foetus appeared as healthy and as well-developed as the others I had secured. I did not find any more parasites on this specimen than on the others—all were well supplied! The only ectoparasites I found on the bats were numerous spider-like wingless flies belonging to the family *Nycteribidae*[1], *Cyclopodea sykesi* Westw. These parasites are well known and have been recorded before from Flying-Foxes. So far I have not discovered any internal parasites visible to the naked eye.

In my previous article on these bats I referred to a number of food plants visited by them. To this I must now add the Cashu (*Anacardium occidentale* L.) and the Mango (*Mangifera indica* L.). The bats attack the fleshy pedicels of the *Cashu* on the verge of ripening for the sake of the copious juice. In previous years I had often noticed these bats hanging on mango trees during the flowering season, but at the time I did not suspect any association between the bat and the mango. This year, however, my curiosity was aroused by the litter of flowers and branches of the inflorescence lying on the road as I 'padded' my way to work. At first I could not explain this destruction, but it dawned on me that it might possibly be due to the work of bats; natural causes could not account for healthy flowers on the road. My suspicions aroused, I determined to watch the bats, and it was not long before evidence was forthcoming. I noticed that the animals clambered about the

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[1] I am indebted to Dr. B. Prashad for the identification.

inflorescences, and as they went detached part of the branches. At the same time, they appeared to be chewing, but what? I shot some and found that their mouths were crammed with mango blossom. Here then were the culprits. On dissection an examination of the stomach contents revealed that the stomachs contained only liquid and in the liquid microscopical fragments of petals, sepals, pollen, and fragments of the larvae of the Mango Hopper (*Idiocerus* sp.) and small *Diptera* which had passed unavoidably down with the nectar. It was now time to turn my attention to the mango flowers and learn a little more about them. Mango flowers open at dusk and a very copious amount of nectar begins to exude from the large nectaries. So plentiful is the exudation that it soon begins to drip like dew from a roof—this is what the bats are after, and, as the flowers are small, quantities have to be masticated. Any movement of the inflorescence, as for example, by the wind, causes the sprinkling of the neighbouring area with nectar. Though the bats destroy a considerable quantity of the blossom, yet sufficient escapes their attention to produce a good crop in good years when the blossom is not attacked by other enemies.

Incidentally, this year there was a bumper crop of mango bloom in Salsette, though all came to nothing—the crop has failed, but the bats were not responsible for this. As already indicated, the flowers produce a considerable quantity of nectar which drips like dew and is sprinkled on everything around. In some years the drip of nectar is excessive, and the trees and the ground below become coated with the sticky secretion. It forms a thin film over the foliage and the inflorescences. In the sun this film hardens and glistens. At night the heavy dew moistens it and is partly washed down, but fresh secretion from the flowers makes up for the loss. This goes on from day to day. The film of nectar forms a suitable culture for the development of a black fungus which soon spreads over the trees coated with nectar. In a short while the trees appear blackened as though charred or covered with soot. The local people refer to this condition as 'burnt' (*jul gāyā*). Actually the fungus masks the leaves and tender parts, thereby seriously obstructing the normal functions of the tissues. The inflorescences disintegrate soon after a covering of the fungus has appeared, and nothing is left, not even those flowers that 'set' fruit. It is the end of the mango crop for that year. As the weather becomes drier, the fungus film cracks and flakes off, and what remains is washed away by the rains. That the fungus is a result of an excessive secretion of nectar is borne out by the examination of isolated trees. Only the side or sides on which the blooms appear are affected by the fungus while the non-flowering portions remain unaffected. When trees are crowded and branches are interlocked, the entire trees are affected and these conditions perhaps assist largely in the spread of the disease[1]. When trees

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[1] The bats probably assist in the spread of the disease by carrying the fungus from one tree to another on their bodies.

are badly affected the whole tree and the ground below, protected by the circumference of the crown, is coated black.

Apart from the failure of the fruit crop, the trees actually suffer little damage from the fungus attack. The excessive exudation of nectar leads me to another point, namely, a local belief and practice. The locals annually hack a ring of deep incisions round the stem in the belief that this practice is instrumental in ensuring a good crop. The reason for this practice is the belief that by doing so they reduce the amount of sap reaching the young fruit which, if excessive, causes the fruit to drop soon after setting. How this belief arose is difficult to imagine, but perhaps the practice, if properly carried out without seriously injuring the trees, may truely help to reduce an excessive ascent of sap to the flowers, and thereby reduce an excessive nectar secretion. A consequent reduction in the danger of fungus growth might be the result. However interesting this subject, it is beyond the scope of this paper and I must return to the bats.

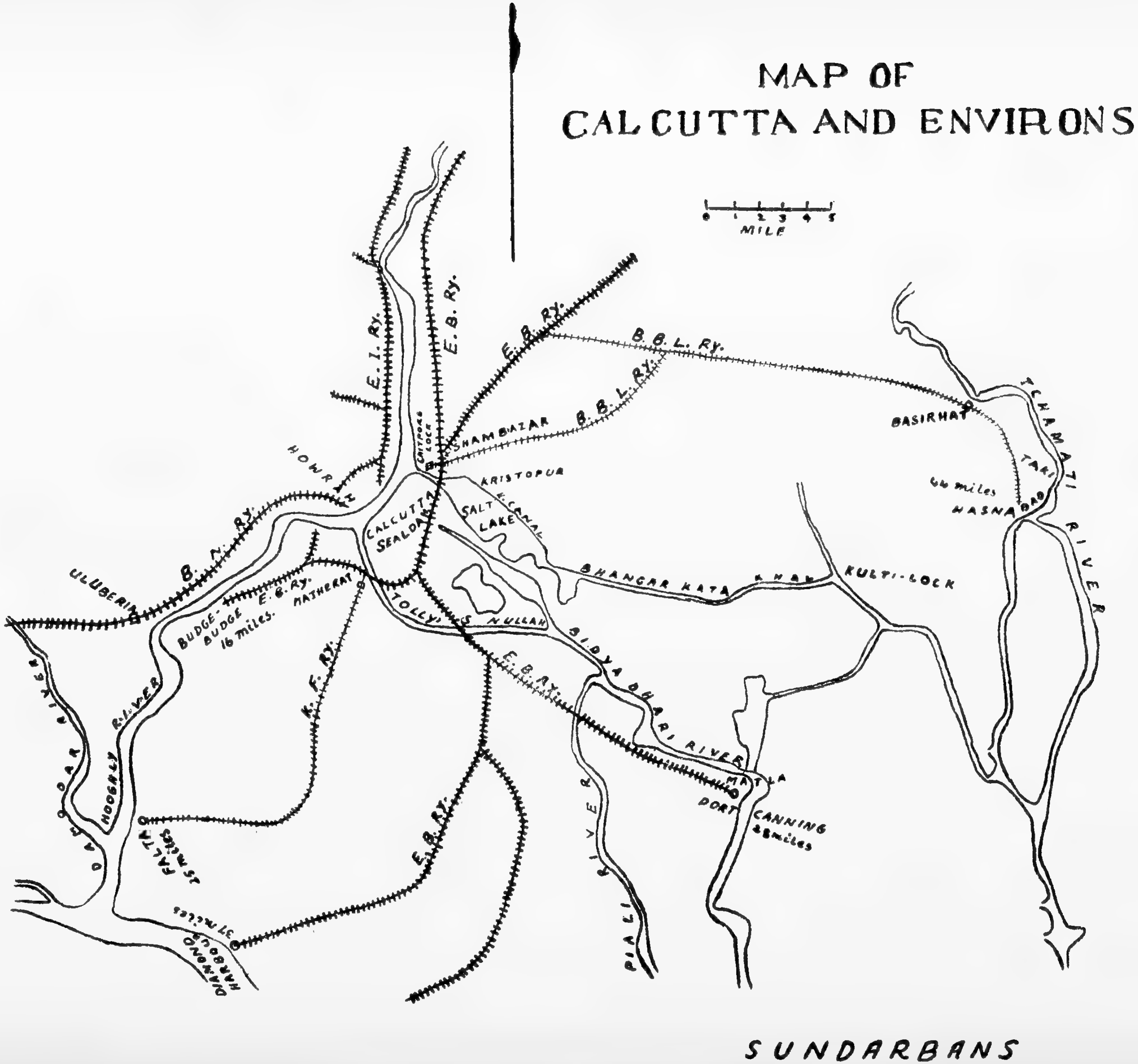
As the flowers of *Bombax* and mango became less the bats became fewer in proportion till finally they disappeared from the area. *Erythrina indica* and *E. stricta* now came into full bloom, but these blossoms were not visited by the bats. The flowers of *Erythrina* open towards morning and the greatest amount of nectar is produced during the hours of daylight, and are thus not suited for bat visitors. These flowers are chiefly pollinated by bird visitors and other diurnal animals. Strangely enough in the cases of *Bombax* and *Erythrina* we see trees with similarly coloured flowers—red—one adapted for nocturnal pollination and the other for diurnal pollination! The fact that *Bombax* is a night flowering plant is borne out by the fact that the buds open in the evening and the greatest amount of nectar is produced soon after. True the flowers keep open for a considerable time before they fall, and what pollination may have escaped the efforts of the bats, may be completed by the early birds and other visitors; but the chances of pollination by diurnal visitors is small. However, my casual observations on the fertilization of *Bombax* suggest yet another means, that the flowers are not merely adapted for cross-fertilization, but for self-fertilization also! I have examined numerous flowers at various times of day and night and I have been led to the conclusion that the outer bundles of stamens, forming a ring around the edge of the 'cup' of the flower, mature first and are shorter than the style. The bat visitors must first come in contact with the stigma before coming to the staminal ring where the muzzle becomes dusted with pollen and so on for each flower to effect cross-fertilization, as they attempt to get at the bottom of the cup for nectar. Besides this staminal ring there is another bundle of stamens surrounding the base of the style. At first this group of stamens is shorter than the style, the stigma is well above them. Later some stamens of this bundle begin to elongate and the anthers at the top of these stamens reach the same level as the stigma, this usually takes place the day after the opening. Failing cross-fertilization the stigma now stands a chance of self-fertilization by pollen from these lately elongated stamens.

Nature appears to take few chances and so provides for emergencies when the question of propagation is at stake! I am aware of several cases in which there is this double provision. However, in spite of the time I have spent, and the many flowers I have examined, the observation must be taken with reserve until further light is shed on the subject. It is beyond the scope of this paper to discuss the values of cross- and self-fertilization, which belongs to another department of natural history.

Turning from the activities of the Flying-Foxes to those of the Fulvous Fruit-Bat (*R. leschenaulti*) which often feeds in company with its bigger relative, I have just a little to add to what I have already written in my article on this species in volume xli, p. 805 of the *Journal*. At the same time as I observed the Flying-Foxes feeding on mango flowers, *Rousettus* often came into the picture. Like *Pteropus, Rousettus* was also feeding on the mango blossoms. Many of the specimens were sticky with nectar and occasionally I saw some just hanging and licking themselves clean. Likewise *Rousettus* was feeding on *Bombax* and Cashu. They also fed on the fruit of *Mimusops hexandra* Roxb. During the flowering season of this tree these bats also visit it. The females secured were all gravid and contained well-developed foetuses. This period coincides with my former observations.

The fact that the breeding, or rather the birth, of *Pteropus* and that of *Rousettus* coincide, confirms the fact that the period is largely influenced, if not entirely governed, by the food supply of the parents when the nursing mothers require nourishing and sustained supply for the well being of themselves and their young. These further observations on the two bats confirm my belief that the fruit-bats are in reality nectar feeders and juice feeders, only eating such fruit entire which readily liquefy.

Though these bats feed on mango flowers, they evidently do not do as much damage to the crop as at first sight might appear to be the case, for in good years when the blossom is free from fungus and other attacks there is generally a bumper crop of fruit in spite of the attacks of the bats. Therefore I am not in favour of the destruction of the bats on this account. Their destruction may mean a great loss in some other direction yet unknown and unforeseen.



Sen—Distribution of *Anopheles Sundaicus* Rodenw.

DISTRIBUTION OF *ANOPHELES SUNDAICUS* RODENW. THROUGH MECHANICAL MEANS.[1]

BY

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(*With a map*).

Mechanical transport of insect pests from one country to another through sea-going vessels or country craft has been long known, and quarantine measures against several of such pests are in practice in almost all progressive countries. The list of pests thus accidentally introduced is very exhaustive. While these instances mostly relate to the agricultural and forest pests, mosquitoes making long distance journeys and passing from one country to another, in railway carriages are also on record (Howard, Dyar & Knab, 1912).

An example of dispersal of a more limited nature, inside the same country, is afforded by the species *Anopheles sundaicus* Rodenw., a virulent carrier of malaria, which, so far as the records go, was originally known in this province only from the coastal tracts such as the Sundarbans, the species being a saltwater breeder. In 1910 the range of the species was upto Matla and Port Canning about 30 miles away from Calcutta (Gravely 1912). In 1930, the species made a further push inland to Budge-Budge, only 16 miles from Calcutta (*vide* map attached), where a sudden malarial outbreak was experienced in the locality (Iyengar 1931).

Since then, the distribution of the species has been under constant investigation, and an explanation for the factors responsible for similar invasions towards inland areas has been sought for and a close watch has been kept on the vast marshy areas to the immediate east of Calcutta, the salt lakes, which apparently seem very suitable for the establishment of the species.

Constant vigilance led to the detection for the first time in 1931 of an instance of transport of the mosquito into this area by means of a country boat which entered the canal bordering the salt lakes and which had evidently passed *en route* through a *sundaicus* infested zone in the Sundarbans, (Sen 1938). After this discovery, systematic searches of boats and trains reaching Calcutta at different termini were carried out, and it soon became evident that the invasion of the species was taking place not only by boats through the canal but by trains and through other routes as well.

Trains from Falta (Kalighat Falta Railway), where the species was breeding profusely, on being searched at Majherat, the city

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[1] Read before the 28th Session of the Indian Science Congress, 1941.

station of the railway, as also trains from Basirhat and Hasnabad (Barasat Basirhat Railway), another *sundaicus* zone, arriving at Shambazar (Calcutta) and certain local trains stopping overnight at Uluberia and Port Canning, some of the known *sundaicus* areas, on examination at Howrah (Bengal Nagpur Railway) and Sealdah South (Eastern Bengal Railway) showed the transport of adult *A. sundaicus* by this means during the period June to August or September 1934 (Table 1). The species was carried by trains to Howrah and Shambazar (both these stations being situated on the outskirts of Calcutta) during the month of November 1933, showing that the mosquito transport is possible in the cold weather as well. Besides *A. sundaicus* the following Anophelines, not concerned in the transmission of malaria in the area involved, were also transported in the years 1933 and 1934 through trains: *A. hyrcanus*, *A. barbirostris*, *A. annularis*, *A. ramsayi*, *A. philippinensis*, *A. vagus*, *A. subpictus*, *A. varuna*, *A. aconitus* and *A. stephensi*.

TABLE I

Transport in trains.[1]

Stations where trains were examined	Period of Investigation	No. of trains examined	No. of trains showing *A. sundaicus*	No. of adult *A. sundaicus* caught	Other species recorded
Majherat ...	August 1933	?	nil.	nil.	?
	September ,,	?	,,	,,	?
	October ,,	7	,,	,,	*A. vagus, A. annularis, A. hyrcanus, A. ramsayi.*
	November ,,	12	,,	,,	*A. barbirostris, A. hyrcanus, A. annularis, A. vagus, A. varuna.*
	December ,,	11	,,	,,	*A. subpictus, A. vagus, A. hyrcanus, A. philippinensis.*
	January 1934	7	,,	,,	*A. subpictus, A. vagus, A. hyrcanus.*
	February ,,	1	,,	,,	*A. vagus.*
	March ,,	3	,,	,,	*A. subpictus, A. vagus, A. hyrcanus.*
	April ,,	2	,,	,,	*A. vagus.*
	May ,,	1	,,	,,	*A. vagus.*
	June ,,	12	3	9	*A. subpictus, A. vagus, A. annularis.*
	July ,,	14	4	10	*A. subpictus, A. vagus, A. varuna, A. hyrcanus, A. ramsayi.*

[1] Detailed data from month to month are not available for Sealdah, and the station is therefore omitted from Table I.

TABLE I—(*continued*)

Stations where trains were examined	Period of Investigation	No. of trains examined	No. of trains showing *A. sundaicus*	No. of adult *A. sundaicus* caught	Other species recorded
Majherat ...	August 1934	16	1	1	*A. subpictus, A. vagus, A. varuna, A. aconitus, A. hyrcanus, A. ramsayi.*
	September ,,	10	nil.	nil.	*A. subpictus, A. vagus, A. hyrcanus.*
	October ,,	7	,,	,,	*A. vagus, A. hyrcanus.*
Shambazar.	November 1933	4	1	1	*A. vagus, A. annularis, A. hyrcanus, A. ramsayi.*
	December ,,	6	nil.	nil.	*A. annularis, A. hyrcanus, A. barbirostris.*
	January 1934	2	,,	,,	*A. subpictus, A. annularis.*
	February ,,	?	,,	,,	?
	March ,,	1	,,	,,	*A. subpictus, A. annularis.*
	April ,,	3	1	1	*A. vagus.*
	May ,,	1	nil.	nil.	*A. vagus, A. subpictus.*
	June ,,	7	3	26	*A. subpictus, A. vagus, A. annularis.*
	July ,,	8	6	25	*A. subpictus, A. vagus.*
	August ,,	8	4	12	*A. subpictus, A. vagus, A. annularis, A. hyrcanus.*
	September ,,	13	3	7	*A. subpictus, A. vagus, A. varuna, A. aconitus, A. hyrcanus, A. ramsayi.*
Howrah ...	August 1933	?	nil.	nil.	?
	September ,,	?	,,	,,	?
	October ,,	3	,,	,,	*A. hyrcanus.*
	November ,,	5	1	1	*A. vagus, A. annularis, A. hyrcanus, A. barbirostris.*
	December ,,	9	nil.	nil.	*A. vagus, A. annularis, A. hyrcanus, A. barbirostris, A. aconitus.*

TABLE I—(*continued*)

Stations where trains were examined	Period of Investigation	No. of trains examined	No. of trains showing *A. sundaicus*	No. of adult *A. sundaicus* caught	Other species recorded
Howrah ...	January 1934	2	nil.	nil.	*A. aconitus.*
	February ,,	5	,,	,,	*A. subpictus, A. vagus, A. annularis, A. varuna, A. hyrcanus, A. barbirostris, A. stephensi.*
	March ,,	10	,,	,,	*A. vagus, A. varuna, A. aconitus, A. hyrcanus, A. philippinensis.*
	April ,,	6	,,	,,	*A. vagus, A. annularis, A. varuna, A. aconitus, A. barbirostris, A. ramsayi.*
	May ,,	9	,,	,,	*A. subpictus, A. vagus, A. ramsayi.*
	June ,,	10	2	2	*A. subpictus, A. vagus, A. ramsayi.*
	July ,,	8	2	2	*A. subpictus, A. vagus, A. hyrcanus, A. barbirostris.*
	August ,,	8	4	4	*A. subpictus, A. vagus, A. hyrcanus, A. barbirostris.*
	September ,,	2	nil.	nil.	*A. subpictus, A. vagus, A. annularis, A. aconitus, A. hyrcanus.*
	October ,,	1	,,	,,	*A. vagus.*♂
Total ...		234	35	101	

Although 35 out of 234, or nearly 15 per cent, of the trains examined carried *A. sundaicus,* it is however, believed that the transport through boats and not trains, has been really responsible for the ultimate establishment of the species during recent years in the Calcutta Salt Lakes area. The reason is that no trains stop anywhere close to the Salt Lakes proper and the species first started to breed in the Kristopur end of the lakes towards the end of December 1932, where, as already mentioned, infested boats (Fig. 1) were known to be arriving since 1931. Boats to Calcutta are sometimes detained overnight at Kristopur for the realisation of tolls. Moreover, there is ample evidence that active dispersal of the species occurred in 1933 and 1934 by means of boat traffic coming to Calcutta either through (1) the river Hooghly which is in direct line with the *Sundarbans,* or through (2) the river Ichamati which traverses some of the worst *sundaicus* infested zones and to Kristopur Canal bordering the Calcutta Salt Lakes area as will be seen from Table II.

TABLE II

Transport in country boats.

Points where boats were examined	Period of Investigation	No. of boats examined	No. of boats showing *A. sundaicus*	No. of adult *A. sundaicus* caught	Other species recorded
Kulti-Lock.	July 1933	83	14	19	*A. subpictus, A. vagus.*
	Aug., Sept. and Oct. 1933	674	22	29	*A. subpictus, A. vagus.*
	Nov. and Dec. 1933	747	29	38	*A. subpictus, A. vagus, A. varuna.*
	Jan. and Feb. 1934	199	1	2	
	July, Aug. and Sept. 1934	284	31	41	*A. subpictus, A. vagus.*
	Oct., Nov. and Dec. 1934	238	23	?	
Kristopur Toll Office	Aug., Sept. and Oct. 1933	280	2	3	*A. subpictus, A. vagus.*
	Nov. and Dec. 1934	256	5		
Chitpur-Lock	February and March 1934	65	nil.	nil.	
Canning Town	December 1933	206	9	10	
	January and February 1934	30	nil.	nil.	
Total...		3,062	136	142	

It has been found from observations covering a period of one year and a half, i.e., from July 1933 to December 1934, that 136 boats out of 3062 examined, i.e. over 4 per cent, coming up the different routes to Calcutta, were serving as transporting agencies of *A. sundaicus*. Three other species—*A. subpictus, A. vagus,* and *A. varuna*—were also sheltering in the country boats; these three species are however ubiquitous in distribution and of no importance from the malarial point of view in the area.

Of the various types of cargo carried in the country boats sheltering *A. sundaicus,* such as paddy (rice), jute, straw, sugar, molasses, salt, pulses, wood, ginger, garlic, kerosene, matches, nut, banana, goats, fowl, earthen pots, etc., paddy, jute and straw appear to provide a favourable resting place for the species.

The forward and upward thrust of the species to range beyond its original boundary is thought to be due to the extensive clearance of mangrove forests in the Sundarbans and the reclamation of lands for rice cultivation and fishery purposes, thereby creating

conditions for an excessive rise in the insect population. Secondly easier and quicker communications during recent years have provided more advantageous means of safe dispersal of the species into inland areas. Some unaccountable meteorological factors existing some time about the year 1930, the year of *A. sundaicus* invasion to Budge-Budge, as pointed out by Covell (1932), may also be largely responsible for their recent dispersal towards inland areas.

Summary.

Mechanical transport of *Anopheles sundaicus* through trains and country boats during the years 1933 and 1934 is recorded.

Catches made from carriages at the terminal stations of the different railways in Calcutta, having train connections with the outlying *sundaicus* zones in the delta, showed that in addition to *A. sundaicus,* several other species such as *A. hyrcanus, A. barbirostris, A. annularis, A. ramsayi, A. philippinensis, A. vagus, A. subpictus, A. varuna, A. aconitus,* and *A. stephensi* are also mechanically transported into the city.

Country boats passing through the *Sundarbans* and other *sundaicus* infested areas on arrival at Calcutta by different routes revealed the presence of *A. sundaicus* under shelter of the cargo. Along with *A. sundaicus,* the species *A. subpictus, A. vagus,* and *A. varuna* were also dispersed through these boats.

Nearly 15 per cent of the trains examined carried *A. sundaicus,* while about 4 per cent of the country boats examined were responsible for the spread of the species. The dispersal of the species by means of trains was more noticeable from June to September and by country boats during the last six months of the year, July to December.

It is thought that the eventual establishment of *A. sundaicus* in the Salt Lake area to the east of Calcutta has been the outcome of mechanical importation of the species through the agency of country boats.

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Plumbago zeylanica Linn.

SOME COMMON INDIAN HERBS WITH NOTES ON THEIR ANATOMICAL CHARACTERS.

BY

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(*With three plates*).

(*Continued from page 282 of Vol.* xlii *No.* 2).

VII.—PLUMBAGO ZEYLANICA Linn.

(PLUMBAGINACEAE).

SYSTEMATIC DESCRIPTION.

Plumbago zeylanica Linn. Sp. Pl. (1753), 151; H. F. B. I., iii, 480; Cooke. Fl. Pres. Bomb., ii. Pt. i, 78; Dalz. & Gibs. Bomb. Fl. 220; Gamble Fl. Pres. Madras., iv, 744; Kirt. Ind. Med. Plts. II, 1466; Wt. Ill. t. 179.

A subscandent perennial herb; stem somewhat woody, striate. Leaves alternate, entire, ovate, reticulately veined, suddenly narrowed into a short petiole; petiole narrow, amplexicaul at the base where it is often dilated into stipule-like auricles. Flowers in long spikes; rachis glandular, striate; bracteoles ovate, acuminate, shorter than the calyx, glandular. Calyx narrowly tubular, persistent densely covered with stalked glands; limb 5-fid. Corolla white; tube long, slender; lobes 5, obovate-oblong, acute, apiculate. Stamens 5; filaments as long as the corolla-tube, linear, dilated at base; anthers oblong, exserted just beyond the throat. Pollen grains oblong when dry, and spherical when moistened. Ovary free, 1-celled; ovule solitary; style simple, filiform; stigmas 5. Fruit an oblong pointed capsule, 1-seeded. (Plates I-II). Flowers: Aug.-Sept. Medicinal (Kirtikar, 5).

INDIAN NAMES.

Chitalakri (*Urdu*), Chita, Chitarak (*Hindi*); Agnimata, Chitramulamu (*Telugu*); Kanilan, Sittragam (*Tamil*); Chitraka, Chitu (*Marathi*); Tumpukotuveli (*Malayalam*); Chitramula (*Canarese*); Agni, Chitra, Chitraka (*Sanskrit*); Chita, Chitruk (*Bengali*); Shitarak (*Persian*); Shitaraj (*Arabic*).

HABITAT.

Throughout India, wild in the south (Hooker, 4); hills throughout the Konkan (Dalz. & Gibs, 2); all districts in the Plains,

common, wild or in cultivation (Gamble, 3); wild in Hyderabad (Sayeedud-Din, 7); in hedges and jungles in Madras (Mayuranathan, 6).

Distribution: Throughout India, much cultivated, wild in the W. Peninsula and probably in Bengal, Ceylon, Tropics of the Old World.

Anatomical Notes.

Structure of the leaf. The epidermal cells are large, and possess a thick cuticle, which is striated. Stomata occur on both sides of the leaf in more or less equal abundance, and are rather depressed. They are of the cruciferous type (Plate iii, Fig. 3), as is recorded by Solereder and Strasburger in other species (Solereder, 8). The mesophyll is hardly differentiated into palisade and spongy tissue. There is no hairy covering, but the presence of chalk-glands is very characteristic. They occur on the branches also. A chalk-gland consists of a hemispherical group of eight cells (Plate III, Fig. 1) which have very thin walls, except those which separate the gland from the adjacent tissue. Along with water salts of lime are excreted, as is evident from the white coating on the surface of the leaves and branches. These excretions are a safeguard against excessive transpiration, and in keeping with the dry habitat of this plant. Not only this, but the glands are also depressed below the level of the epidermal surface like the depressed stomata.

Oxalate of lime occurs in the form of small clustered crystals. Cells filled with a granular secretion, probably plumbagin, occur in abundance. They are also found in the stem (Plate III, Fig. 5).

Structure of the petiole (Plate III, Fig. 4). It is v-shaped in transverse section owing to the lateral dilations, and is traversed by as many as eighteen vascular bundles.

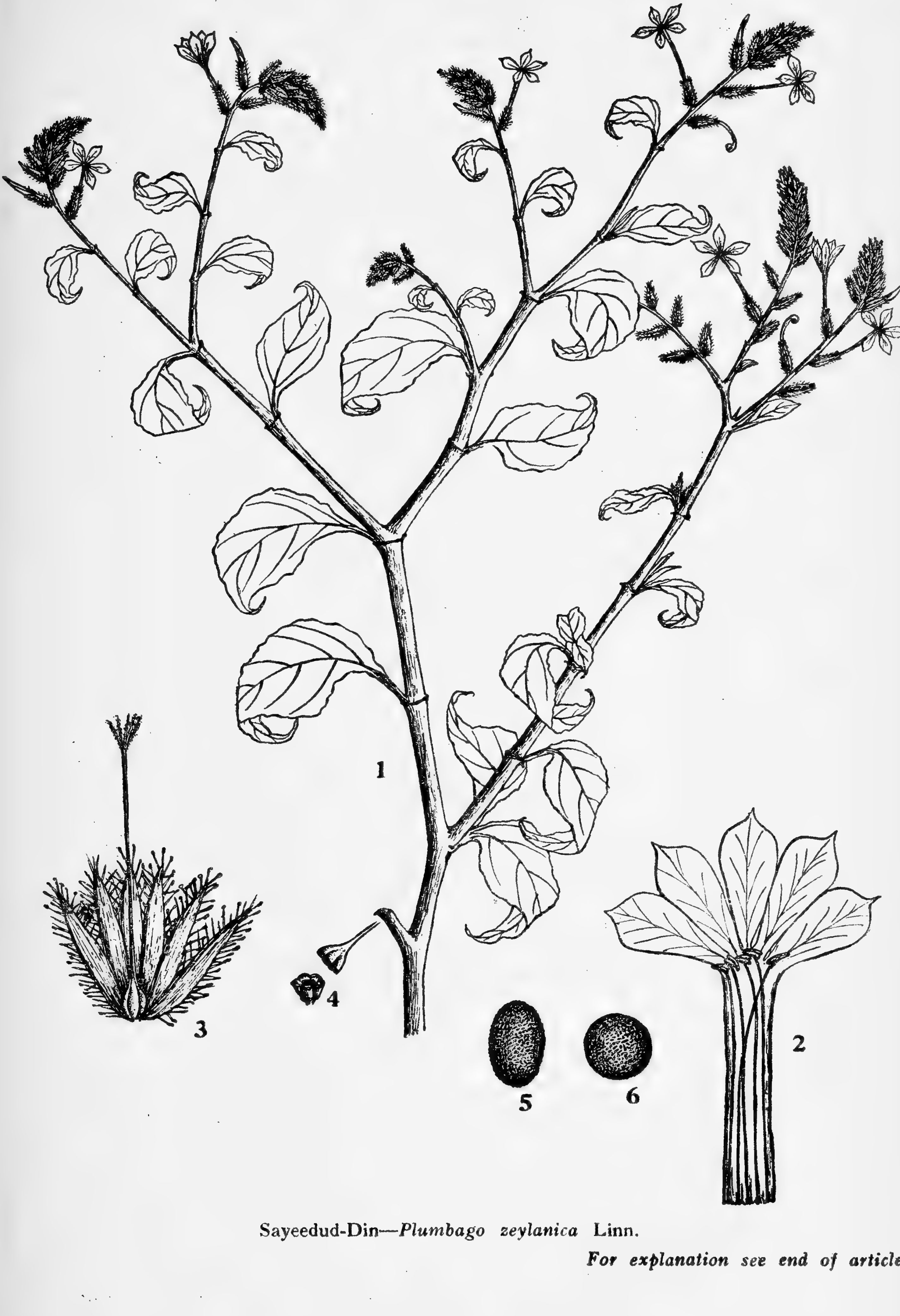
Structure of the stem. The primary cortex contains collenchyma and sclerenchyma more or less in a continuous ring. The ridges contain more of these tissues than the furrows. The vascular bundles are collateral. There are broad medullary rays.

Hairs on the calyx. The calyx is densely covered with long-stalked glandular shaggy hairs (Plate III, Fig. 6) full of secretion. These hairs consist of a long unicellular stalk and a round head. Besides these, mucilage glands occur (Plate III, Fig. 7). Each gland which is circular in outline with a wavy margin, consists of a group of about 30-35 thin-walled epidermal cells filled with mucilage.

Conclusions.

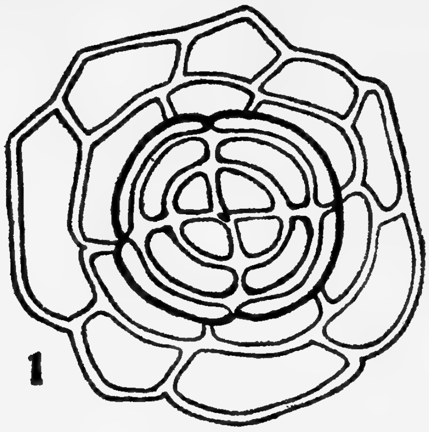
The following are the chief features revealed by the anatomical study of this plant :

1. Stomata are of the cruciferous type.
2. Characteristic chalk-glands occur on the leaves and on the branches.
3. The only hairy covering is found on the calyx, and consists of long-stalked glandular shaggy hairs.



Sayeedud-Din—*Plumbago zeylanica* Linn.

For explanation see end of article.



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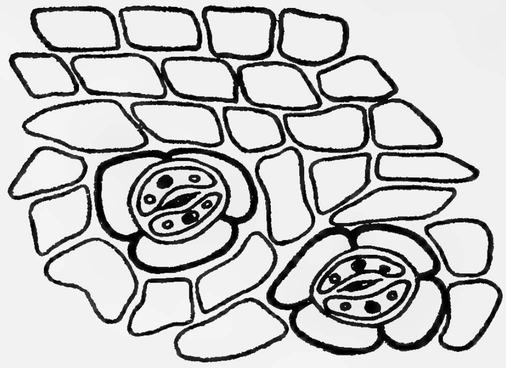

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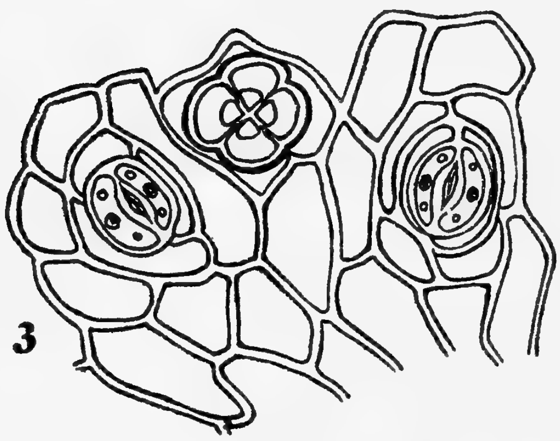

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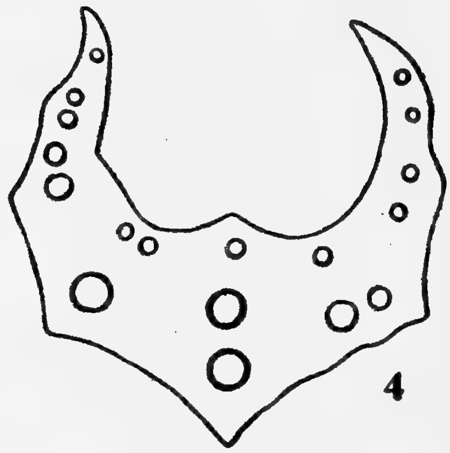

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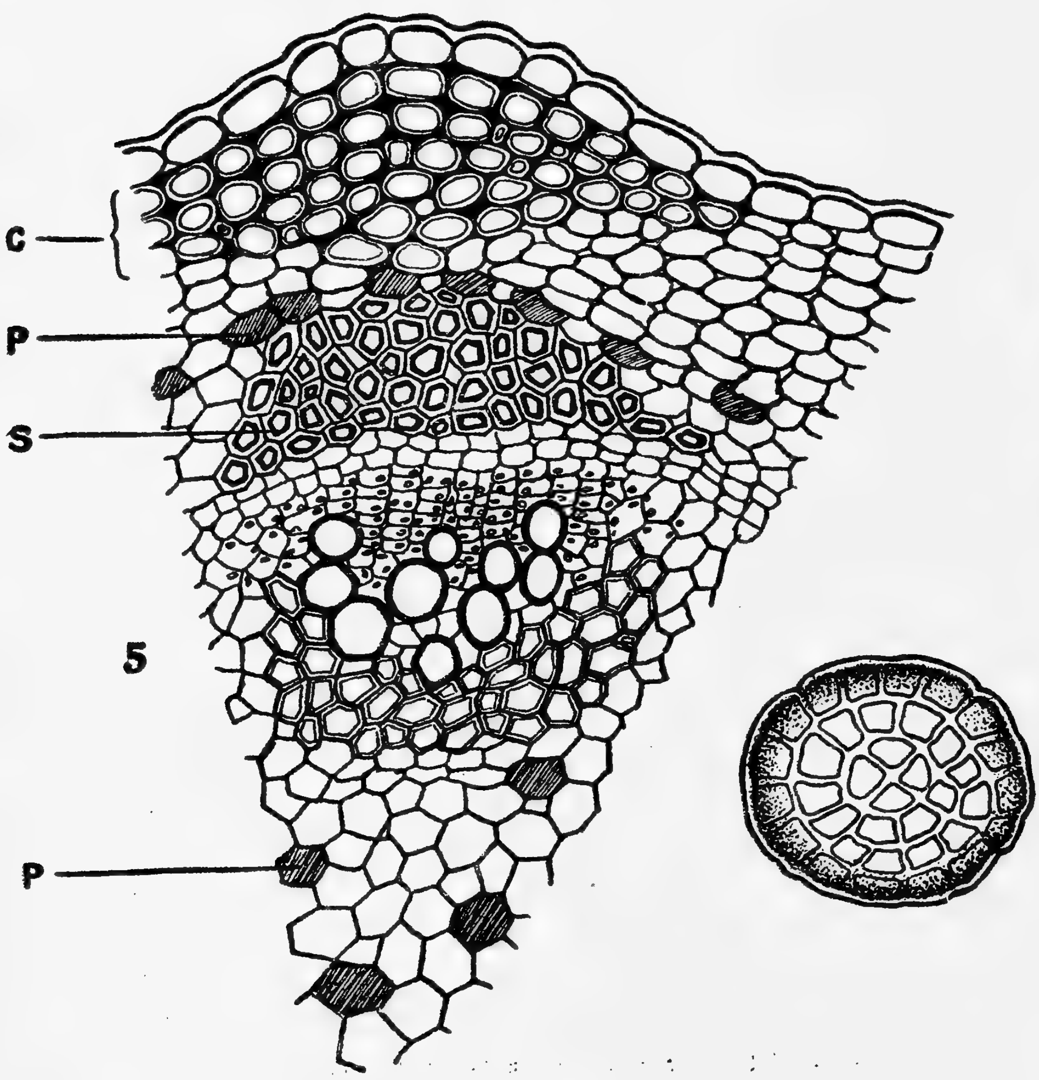

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Sayeedud-Din—*Plumbago zeylanica* Linn.

For explanation see end of article.

4. Mucilage glands also occur on the calyx.

5. Oxalate of lime occurs in the form of clustered crystals in the leaf.

6. Mesophyll is undifferentiated.

7. Cells filled with a secretion, probably plumbagin, occur in the leaf and stem.

8. In the structure of the stem more or less a continuous ring of collenchyma and sclerenchyma may be noted.

Acknowledgements.

My thanks are due to Mr. Sri Ramloo for the preparation of the drawings, and to Mr. M. Moinuddin for the preparation of several microscopic slides for anatomical study.

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Explanation of Plates I to III.

Plumbago zeylanica Linn.

Plate I.

Photograph of a portion of *Plumbago zeylanica* Linn.

Plate II.

Fig. 1.—Black and white drawing of *Plumbago zeylanica* Linn. a small uppermost portion (× ½).
Fig. 2. Corolla opened out. (× 5).
Fig. 3. Pistil with calyx attached. (× 5).
Fig. 4. Ovary cut across. (× 5).
Fig. 5. Pollen grain in dry condition. (× 150).
Fig. 6. Pollen grain, moistened. (× 150).

Plate III.

Fig. 1. A chalk-gland from the stem-epidermis. (× 600).
Fig. 2. Stem-epidermis, showing stomata of the cruciferous type. (× 300).
Fig. 3. Leaf-epidermis, showing stomata and a chalk-gland. (× 300).
Fig. 4. T. S. Petiole, diagrammatic. (× 20).
Fig. 5. T. S. Stem, showing c, collenchyma; s, sclerenchyma; p, cells filled with plumbagin, and a vascular bundle. (× 300).
Fig. 6. A stalked glandular shaggy hair from calyx. (× 80).
Fig. 7. A mucilage gland from calyx. (× 300).

TWO NATURALISTS VISIT KARWAR, NORTH KANARA.

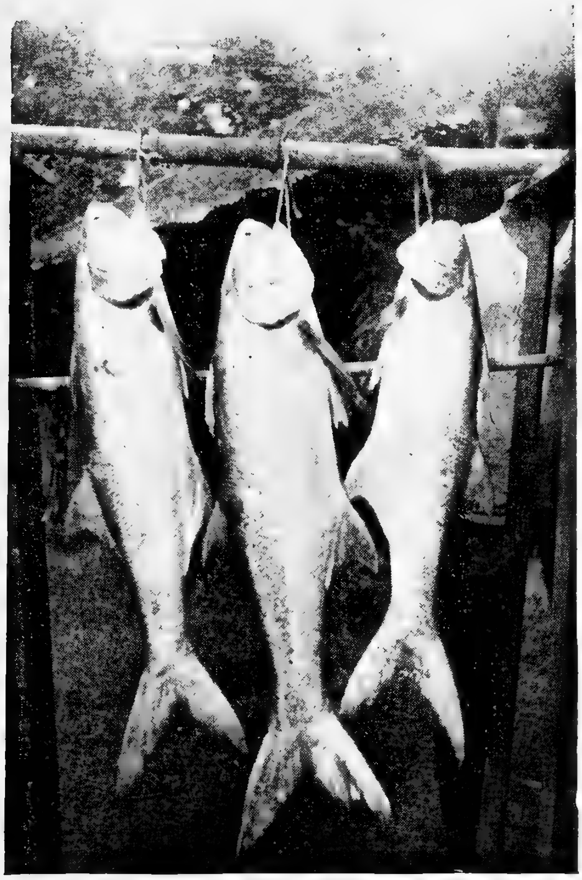
BY

CHARLES McCANN, F.L.S.

(*With one plate*).

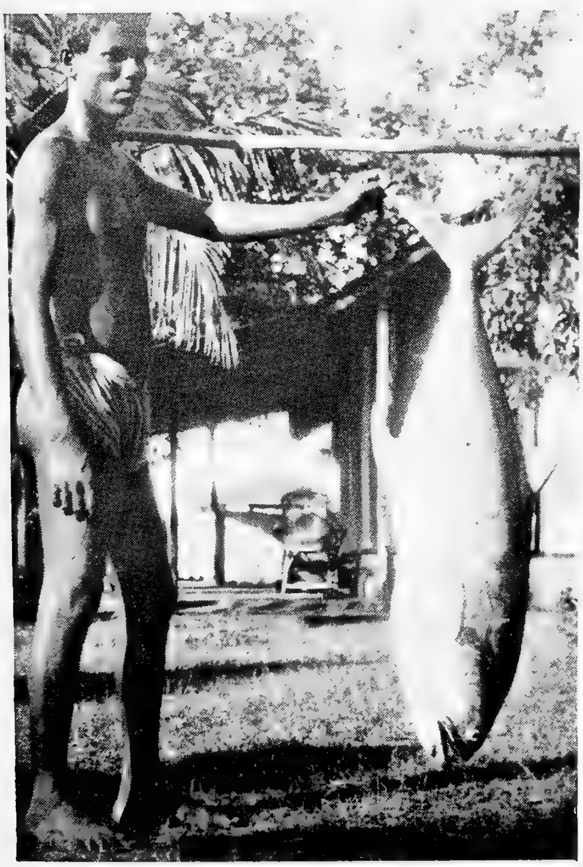
With Dr. M. Suter, a naturalist with a weakness for fishing, I went last September on a fishing trip to Karwar. As my interest in fish is limited to the eating of them, it was agreed that while the fisherman was occupied with his fish, I should 'prowl' around alone, otherwise we would seek together the things which interest naturalists. We left Poona by car at dawn on the 2nd September (1940) in order to arrive at Karwar the same evening. The Deccan country, familiar to both of us, did not offer much of interest, but having written previously, jointly with Mr. Hughes (*Journ., B.N.H.S.,* vol. xli, p. 446) on some aspects of bird-life observed along the same route at the break of the monsoon, I was naturally interested to see what it was like towards the end. In the paper quoted above, we remarked on the absence of the drongos, rollers and orioles from the open Deccan. Again these birds were conspicuous by their absence. The drongos and orioles were seen in the forested areas as before, but the rollers were not to be seen at all! It seems clear that these birds move to more suitable localities during the rains.

At Khanapur—a most appropriate name—we stopped to eat and to give the driver a rest. In the ensuing investigation into the anatomy of *Gallus domesticus,* we both proved ourselves excellent 'myologists'; the study of the osteology was left to the expert attention of the local pie-dog. Towards evening we reached the Arbail Ghat. The forest looked inviting and we walked down part of the Ghat in the hope of seeing something to interest us. We were not disappointed. Hanging on fine rootlets in the pockets of old cuttings along the roadside were the beautiful, inverted pear-shaped nests of the wasp *Paravespa eva* Bell. With its lace-like entrance finished off with a leaf-like appendage this nest in its beauty and delicacy, is one of the finest examples of insect craftsmanship. Here and there in the same cuttings were the great burrows of the large, brown, velvety spider, Mygale—the largest Indian spider. Mygale will stand up to almost anything in defence, but being nocturnal none were seen. The Giant Malabar Squirrel (*Ratufa indica* Exrln.) was occasionally heard. Flowers were not yet profuse, but a beautiful *Osbeckia* was fairly common; its large pink flowers standing out obtrusively from the surrounding green. As we were anxious to get to Karwar before dark we did not delay too long on the Ghat and arrived at the Grand Hotel a little before dark. News was already abroad that Dr. Suter was due that evening, so the interested were ready to receive us at the gate as the car drew up. Not having been in Karwar for twenty years, I was unknown, but Dr. Suter exchanged greetings with old friends,



1. A good catch of Ravas.
(*P. tetradactylus*)

2. Mr. Adams with a 25 lb. Ravas.



A 35 lb. Dagool.
(*Scomberoides toloo* Cuv. & Val.)

Fishing for Ghol
(*Sciaena sina* Cuv. & Val.) in Karwar Harbour.

Photos by Dr. M. Suter.

prominent among whom was his *tindal,* Januba. The success of the fishing depended much on the good work of this gentleman. Later came Mr. William D'Souza, chairman of the local municipality, commander of the Civic Guard, and last, but not least, proprietor of the Grand Hotel. As he was responsible for the information regarding the frequency of Ravas (*Polynemus*) and the possibilities of a good season, Dr. Suter naturally wanted to hear all the 'fishy' news. Mr. D'Souza had made a fair catch that day, so the prospect seemed promising. We were the only visitors at the time in the hotel and so were able to spread ourselves out. After dinner, plans were decided upon for the morrow—and so to bed.

Before sunrise the next morning, Dr. Suter disappeared in his dug-out over the horizon to tempt the Ravas. He knew just where to find them and was sure to get some, if they were there and in the mood to bite. Soon after my host's departure, I set out on a reconnoitering trip in the forests behind the hotel. I am not going to describe the beauties of Karwar, natural or human, for these have been fully described in that all informative book, the Gazeteer. Legend has it that Karwar was once famous for its beautiful women, but if this were so, it must have been in the Stone Age, or perhaps my eyes are inert to such attractions!

When I set out burdened with the necessary collecting gear, the sky was overcast and there were light showers from time to time, but later in the day it cleared up leaving the wet foliage glistening in the bright sunshine. Butterflies were plentiful and the rain did not seem to hamper their activity in any way. *Papilio aristolochiae* was by far the commonest. They drifted about in great profusion. Now and again a great Bird-wing (*Troides helena minos* Cr.) floated quietly into the picture. Unlike the occasional *Papilio polymnestor* Cr., it was in no hurry, but a false stroke with the net spurred it to an exhibition of high speed. Not being an expert in the art of netting butterflies, I was often left standing gazing after the rapidly departing flashes of black and golden yellow. Very occasionally a metalic green flash announced the arrival and departure of *Papilio buddha* Wd. — a prize for butterfly hunters. This 'speed merchant' was too much for amateurish me, I just raised my hat as it passed—I was beaten! and I do not think that I am the only one who must acknowledge defeat nor shall I be the last. *Pareronia ceylanica* Fd. was common and many others, too numerous to mention.

As I wandered along, small troops of the Common Langur (*Semnopithecus entellus* Dup.) stopped in the midst of their breakfast on the pulp of the fruit of the Strychnine tree (*Strychnos Nux-vomica* L.), and in keeping with the 'law of the jungle' eyed me suspiciously, prepared to take their departure. Satisfied that I was harmless they resumed their repast. One group of the fauna made its presence felt without being looked for—the mosquitoes. These blood-thirsty gentry were very persistant and with them there were, the leaches, also members of the 'blood' brigade. Their elastic bodies expand and contract like an accordeon in full blast. They do their work unobtrusively only betraying

their departure by a gentle trickle of blood from the spot on which they had sat unnoticed at their crimson meal. Fortunately there were not many of them about.

It was afternoon before I was back at the hotel, when I spotted Dr. Suter's dug-out rounding the Karwar headland. I wandered down to the landing to see what success he had had. At the bottom of this boat, lay some fine *Ravas*. According to him the catch was poor and the fish small. In former seasons he had had much better sport. The *Ravas* come into Karwar harbour towards the end of the rains and make their way up the estuary of the Kalanuddi River to spawn, but for some reason or other, perhaps Adolf Hitler—or the peculiar weather conditions experienced this year, the run was not good. The fish seemed fewer than in former years.

Evenings were devoted to joint effort in natural history. Day after day we set out on our respective hobbies. As the fishing had not been up to expectations, Dr. Suter suggested a visit to Kurmagad Island on the 6th morning. Dr. Suter had informed me of the existence of a terrapin on Kurmagad Island, he suggested that it differed from the mainland form. Later he presented me with three from the island and one from the mainland. These terrapins belong to the genus *Geoemyda*, probably *G. trijuga*, but as I have the species under observation I must leave these conclusions for a subsequent paper. There is certainly some differences between the two forms. The mainland terrapin appears to be larger, while the island form is more variable both in shape and texture of carapace. The difference in size is probably due to an almost unlimited food supply on the mainland and its limitations on the island. The greater variability in the carapace of the island form may arise from inbreeding due to the more limited supply of partners.

Being interested, I was glad of an opportunity to visit the island and look over it myself. Kurmagad is a small island, rising some 180 ft. above sea level. Its shores are girdled with rocks covered thickly with oysters—but a semblance of a beach on the south-eastern side affords a safe landing. The island was formerly encircled with walls which have now almost disappeared or are fast crumbling. It was a fort, built by Shivaji, which played an important part in the defence of Karwar. At the time of our visit, the island was covered in dense, rank vegetation which shrouded the greater part of the ruins.

Though uninhabited, it is visited by fishermen who fish round it. During the rains, a few cattle are released on it for grazing but they are removed after the rains—there is little to support them during the dry months. Uninhabited by mortals, the Island is the abode of a deity—Narsinh, whose shrine, after the rains, is also buried under vegetation. The solitude of the god is disturbed annually during the cold season (December) by a great concourse of people from the mainland who gather there to pay him homage. In this lonely spot, Narsinh rules over a quaint little fauna and flora. Sweet water is scarce. There is a small well just above the sandy beech, but it is neglected and the water is foul. Clumps

of *Clerodendron inerme* border the sandy strip of beech. To the left is the twisted trunk of a weather beaten mangrove (*Avicennia* sp.). A few cocoanuts have been planted. The forest is of the deciduous type, differing little from the adjoining mainland. *Sterculia urens* Roxb. with its pinkish, pealing bark stands out prominently. From the beach a rude stairway of broad steps leads up a short distance to a path going round the island. Along the path, to the right, is a small rock-cut cistern, at the time filled with putrid water. In it there were several specimens of the Skipper Frog (*Rana cyanophlictis*), not to mention a host of insect larvae. The Bull-Frog (*Rana tigrina* Daud.) is yet another inhabitant. While I was on the beach, a half-grown bull-frog hopped up as fast as it could from the sea—covered in sand. It evidently did not like its saline bath. Did it fall into the sea from the island, or was it a new arrival washed out to sea from the mainland?

As we proceeded along the overgrown path we passed through an almost pure association of *Costus speciosa* Smith. In places this plant had taken possession of the ground to the exclusion of all else. As it was in flower it attracted numerous insect visitors. Some species of vine (*Vitis* spp.) scrambled about here and there. We noted two different species of *Habenaria* in fruit. In places there were flourishing clumps of bamboos. These combined with *Zizyphus* and other thorny bushes made progress in places difficult.

On our way to the island we saw many butterflies, including bird-wings (*Troides*) and various *Papilio* making their way across the sea to various islands. The White-bellied Sea-Eagle [*Haliaëtus leucogaster* (Gmelin)] quartered the sky, keeping a sharp look out for prey. Several of these birds were seen and heard around Karwar. They breed at various points and one pair had a nest, a large affair, on a tree at the eastern corner of Kurmagad, which was clearly visible as one approached the island. The birds were sitting at the time. At the top of the island we came to a flat piece of ground covered with *Costus* sheltered by some *Eugenia*; here we set about catching insects. Grasshoppers were very plentiful. Butterflies were common, particularly *Pareronia ceylanica* Fd. Occasionally a bird-wing appeared and other *Papilio*. Once the fast-flying *P. helena* made its appearance, but all attempts to bring it to bag failed. Two specimens of the Atlas moth (*Attacus atlas* L.) were also observed, and one brought to bag. While insect hunting we almost barged into a hornets' nest (*Vespa cincta* Fabr.). I shall have more to say about this nest presently. The main object of our visit was to obtain further examples of the terrapins. Owing to the dense nature of the vegetation we were obliged to cut our way through here and there. When so engaged, Dr. Suter discovered a baby terrapin 65×56 mm. in dimensions. In great glee I picked up the little creature and found myself, at once, enveloped in an appalling stench. The author of this 'gas attack' was the terrapin. These animals were versed in 'chemical warfare' long before man! It is well-known that some of the tortoises produce foul odours as a means of defence. This is produced from special glands or by the voiding of the faeces, or by both when attacked. Despite this little reptile's malodorous attempt to ward me off,

it found a place in my collecting bag, and is now a docile resident in my vivarium. Once these animals have got accustomed to handling, they do not generally resort to their vile mode of defence. The terrapins I have in captivity no longer submit me to a 'gas' attack when handled.

At the top of the island there were some drying puddles, which clearly showed prints of terrapin. But we saw none; being nocturnal terrapin retire during the day. We now took to turning over loose stones in damp places, in the hope of finding other animal life—we were not disappointed. I am no 'Col. Longbow', but I can confidently say that under every stone we turned, we found at least one large black rock scorpion[1] (*Palamnaeus* sp.)! Though called the 'black' scorpion in contrast to the 'red' (*Buthus*) it is not black but a very deep green, the chelae being darker than the body. In most cases the adults were with their young. It was breeding time in the scorpion world. The young were well advanced, pigmented but not strongly chitinised. The segments were a light blackish brown, the intersegment tissue being paler. They lived together with the adults on the most filial terms, giving the lie to the old belief that the young commit matricide and devour their mothers. When they are very young, still soft-bodied and creamy white, the mother carries her infants on her back; but once passed that stage, they no longer find room to play 'pic-a-back'. The continuance of the young with the parents suggests that either the 'old dame' does the foraging, and brings home the prey for the young, or that the family go hunting together. In one instance I counted as many as 32 young with a parent! The place was really a hot bed of scorpions.

With the scorpions under the stones lived fat earthworms and some snake-like skinks ([2]*Riopa guentheri* Smith) which scuttled away as soon as they were exposed; and, an occasional frog. A solitary luminous 'centipede' (*Geophillus* sp.) was also observed. Tired of turning stones and of uncovering scorpions and more scorpions, we resumed our quest for terrapins. We searched long and in vain. We had found a young one—the adults must be somewhere in the neighbourhood. Perhaps we did not know how or where to look for them, or had local epicureans forestalled us and captured the lot. This terrapin is relished as a dish by Goans and others. On a previous occasion Dr. Suter had seen some Goan sailors remove eighteen from the island.

Our search led us down the southern slope of the hill. The squealing and racket from a colony of Flying-Foxes (*Pteropus giganteus* Brünn.) drew my attention. Hidden by the undergrowth I was able to approach them quite close. It was a fair sized colony and the first I have seen so far away from a village. Here the bats hung on quite low trees and shrubs, some were barely ten feet from the ground. The colony was composed of adults

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[1] Mr. H. Abdulali when he visited an island off Malwan, found the scorpion in abundance also.

[2] Mr. H. Abdulali found this species a common associate of the scorpions on the island off Malwan.

and young—young of the current year. The young were at once recognizable by their size; while still forming part of the colony, they more or less kept together. A point that struck me was that the usual creamy-coloured areas of the body were much darker in the young—more russet.

I joined Dr. Suter on the beach. He had brought with him some Painted Grasshoppers (*Aularches scabiosae*[1] F.), a few yet in copula ! The 'painted' grasshopper, has a permanent 'make up' and its purpose, oh ladies, is not attraction but detraction. The 'make up' is the same for both sexes. The colours of the insects are 'warning colours'. Dame Nature has gone yet further in the protection of this creature, she has supplied it with an odorous insect's device. There is a small opening at the base of each of the jumping legs. When attacked, an evil smelling frothy mass exudes from these openings—making the succulent grasshopper a thing to be avoided by insect eaters.

I had designs on the beautiful hornets' nest, mentioned before, as I wanted it for the Museum. There was no harm in wanting, but the getting of it was quite another proposition. It was a large egg-shaped affair hanging from some thin branches only about five feet from the ground. The structure was about 18 inches long by a foot wide, the whole enclosed in parchment casing which formed a protection to the horizontally arranged combs within. There was a single entrance about an inch and a half wide. This hanging 'aerodrome' was very much alive. The attack on such a 'fortress' had to be carefully planned. Hornets, have a particularly 'hot tail'. I had nothing with me to commence the attack so I decided to leave the nest alone for the present. The terrapin hunt, having failed, we decided to revisit the island at a later date.

Dr. Suter turned his attention once more to fishing, and I to the jungles. On the 8th another fisherman arrived at the hotel from Poona on a long week-end. His efforts were more successful than Dr. Suter's in way of size, he caught a 16 lb. Ravas. This angler left on the 11th, and we were once more in full possession of the hotel. On the 12th we decided on another terrapin hunt, and the preliminary attack on the hornet stronghold. This time we traversed the island from its south-westerly slope and gradually worked our way up to the top. Cutting a path through the dense growth of *Ficus heterophylla* and other obstructions, we finally came to the spot where we had been on the previous occasion. We had been searching for terrapin for some time when one of the boatmen discovered one. A shout ! and we all assembled to see how and where it had secluded itself. We now learnt just how to look for terrapin. A tell-tale trail usually led to the spot. In a short while we collected quite a number. With each capture there was a fresh determined 'gas attack'. The boatman carrying them pulled awful faces — I don't blame him ! The effluvia were overwhelming.

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[1] The Bombay insect is frequently referred to as *A. millaris* F. but this species does not occur here.

Now for my hornets' nest. My plan was first to plug the entrance with a wad of cotton wool, soaked in chloroform and large enough to stop the hole. The big idea was to kill those imprisoned, and then to deal with the remainder with fire and smoke. In a rain coat with the sleeves tied at the wrists, and a two yard length of sacking over my head, I approached to within eight or ten feet of the nest. I now lay flat on the ground. After thoroughly soaking the cotton wad tied to the end of a bamboo I succeeded in plugging the entrance. Immediately the nest vibrated with angry hornets. The drone of wings from hundreds of hornets trying to escape was menacingly audible. 'Guards' were up looking for the intruder, and those that returned from foraging joined in the hunt. A weak point in my plan of attack was now made clear to me. The bamboo on which the wad was tied, ended under my sacking—a convenient bridge leading direct from the nest to me. The wasps in their rage walked up and down the bamboo, my position was, to say the least, alarming. To keep the offensive patrol from intruding under the sacking and thus getting at me, I gently, but firmly, drew it tightly round the bamboo. Some of the wasps wandered over my head. I have a sturdy skull; unfortunately it is covered with tender skin. I was not too happy, equally was I concerned about my bare ankles, yet another weak spot I had forgotten to protect. Having been stung before by hornets I knew just what they could do to provide a vivid experience in pain. I fearfully watched searching movements as best as I could through the mesh of the coarse sacking. My companions had very wisely retired to a safe distance. I lay as motionless as possible for some time—the minutes ticked away too slowly! When I considered it safe to move, I gradually, very gradually, crept away on my belly backwards to a safe distance. Here I got behind a tree trunk, divested myself of the sacking and the rain coat, and watched the commotion. Any detected movement would have brought the horde of hornets to me. Despite the chloroform hornets were round the nest in hundreds—probably those that had returned from foraging during the assault. The first part of the plan had succeeded, but the second seemed an impossible task by day light, without running the risk of being badly stung—an experience I was not anxious to repeat, so I decided to leave the chloroform plug in for that day and return to finish the job under cover of darkness.

Next evening I returned alone to the attack with a couple of boatmen. On arrival at the spot, I found that the original entrance had been enlarged and a new one made in the external envelope. The nest was very much alive with angry hornets which paraded the outside—these had first to be disposed of. Two flares at the end of bamboos were made and a pile of dry rubbish got together in the sacking. As soon as it was dark I took my stance at the former spot, lit one flare and applied it round the nest singeing the wings of those still outside, and then applied it to the entrances to meet those that poured out. The ground was alive with flightless hornets, but numbers still flew around. Some came dangerously close to my unprotected face, but I kept perfectly still. Gradually

the numbers diminished. The first flare was not enough, so a second was started. By the time it was also exhausted there were still a few hornets emerging from the nest, I was forced to resort to my 'last straw'—the rubbish heap. In the light of the fire I could see that almost all the wasps had gone. I now called to one of the men to hack down the small tree to get the nest clear of the increasing flames. Alas too late ! The nest, cinder-dry with the constant heat, caught fire, just as the tree was about to fall. Before I could quench the flames half the nest had been destroyed. Very disappointed indeed, I returned to the hotel with the charred remains of the nest to show Dr. Suter. In spite of the chloroform and the fire many grubs were still alive in the various combs. The nest, or rather what was left of it, was consigned to the sea.

The various islands in Karwar harbour are biologically interesting, and a careful survey of the fauna and flora would, I am sure, yield interesting results. Unfortunately, the brief period of the trip did not permit of more than a very superficial survey of one or two of the islands. To the southwest of Kurmagad is another forested island, Sunghiri (often referred to as Mudlingad). The approach is difficult owing to the rocky shore. Local belief has it that it is infested with cobras (*Naia tripudians* Linn.). The northern cliffs are inhabited by Blue Rock Pigeons (*Columba livia intermedia* Strick.). Further to the westward on Devgad Island is the Karwar lighthouse. Between Devgad and Mudlingad is another small island clad in forest, often referred to as Little Devgad. The two Devgads are separated by a narrow channel. Owing to the war, visitors are prohibited from landing on the lighthouse island. During the time of our visit the island was covered with rank vegetation. A large Aroid (*Amorphophallus campanulatus* Blume?) had made it a stronghold. In places the plants monopolized large portions of the area, almost to the exclusion of all else. Many of the specimens were extraordinarily well developed. *A. campanulatus,* known in the vernacular as *suran,* is often cultivated for its corms; but I was told that though common on the island, the plant in its wild state, is inedible, as even after cooking, it irritates the mouth. This is due to the abundance of needle-like crystals in its tissue—a characteristic of the order. Dr. Suter, who is well acquainted with many of the islands, told me that he once saw a family of otters[1] (*Lutra* sp.) playing about on the shore of Little Devgad, and that large monitor Lizards (*Varanus monitor* probably) inhabit the island. The lizards, he said, feed largely on marine crabs. The shores of the two Devgad islands abound in large sea-urchins (*Echinodermata*). Later in the season sea-cucumbers (*Holothuroidae*) and other marine animals abound.

While we were at Karwar we saw the commencement of the fishing season. In places the sea was covered with dark patches, often an acre or more, appearing like wind ripples. These patches travelled in various directions—they represented the course of thousands of sardines. The local fisherman went out in pursuit of

[1] Otters may have come down the Kalanuddi River where they are known to exist.

these shoals to secure the first catches of the season. Dolphins followed in the wake of these shoals and ate their fill. The larger predatory fish, such as the *Seer* or *Surmai* (*Cybium guttatum* B. & Sch.), the Dagool (*Scomberoides toloo* Cuv. & Val.) and other large mackerel had not arrived yet. Both these are good sporting fish. A small mackerel, locally known as the *Kokar* (cougher, on account of the coughing sound it makes) was not uncommon. Dr. Suter had caught several of them during our visit. A large perch, locally known as the *Gobra* (Groper), a species of *Serranus,* often attaining great size, was not uncommon. Dr. Suter caught one of 40 pounds. This fish is not considered a sporting fish, as it has the habit of taking the bait and sitting tight between or against rocks. To dislodge such a fish on a sporting line, may be compared to 'Catching a rock' and trying to haul it in. On the 13th the local fishermen were on the lookout for Ghol (*Sciaena sina* Cuv. & Val.). The next day they brought in a big catch of some 2000 fish together with a haul of the Cock-up [*Lates calcarifer* (Bloch)], known as *Kajuri,* around Bombay. This is a fine sporting fish. These fish too were late in their arrival this season judging from the local observers. Various sharks were also among the bag.

Our trip was at its close, so on the 14th night we bid farewell to all our friends, both old and new. Prominent among the former was an old member of the Society, Mr. T. R. Bell[1], who is, 'still going strong' and, 'keeps on walking still'! Among the new (as far as I was concerned) was Mr. Adam, the lighthouse keeper. My name brought back old recollections to him. It turned out that in his youth he was in the same department as my father, and he talked of many old friends that had already been gathered to the majority. He also informed me that he had at the light some old documents signed by my grandfather half a century back, when the old man was Superintendent of Lights. Enough of this family history—good luck Adam, and goodbye. On the 15th morning in the grey dawn the car purred out of Karwar on its long return journey to Poona. Memories were all that were left of the enjoyable trip, and the specimens—silent but forceful recollections. We reached Poona the same night. Before concluding, I must take the opportunity of expressing my sincere thanks to Dr. and Mrs. Suter for their kind hospitality.

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[1] Mr. Bell is engaged in entomological research, and is at present working out the life-histories of moths.

CIRPHIS ALBISTIGMA H.—A PEST OF GRASSES IN SOUTH INDIA.

BY

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INTRODUCTION.

Cirphis albistigma H. (Family: *Noctuidae*)—known as the climbing cutworm of paddy, has been noticed as a serious pest of fodder grasses. During the past decade, its almost frequent occurrence in grasses grown at the cattle farm at Hosur, has demanded a detailed study of this pest in its various aspects. The observations made at Hosur and at Coimbatore during 1937 and 1938 are recorded in this paper.

DISTRIBUTION AND TIME OF OCCURRENCE OF THE PEST.

The occurrence of the pest in paddy in South India has been noted during certain years (Ramachandra Rao, 1927, 1928, 1929 and Ramakrishna Ayyar 1932) in places like Madanapalle, Krishnagiri, Coimbatore, Pollachi in the central districts, from Chingleput down to Tanjore in the coastal tracts on the east coast, and in parts of Malabar on the west coast. While its appearance is sporadic and irregular in paddy, it is a serious pest of grasses in the hilly tracts like Hosur, where it is found usually during the months of October, November, and December. In the year 1937, there was an outbreak in May in addition to the usual occurrence during December. As a pest on paddy it has been recorded during May, October, and also in December during certain years.

NATURE AND EXTENT OF DAMAGE.

At the Hosur cattle farm, situated at an elevation of 3,000 ft. above sea level, and commanding an extensive area of about 1,600 acres, a major portion of which is pasture land, the pest has been noted during successive years from 1928 to 1931, and again in 1937 and 1938 in a serious form. It appears in enormous numbers. The caterpillars cut the tender side shoots of the grass close to the ground reducing a thick grass bed to mere stumps, or they strip the long wiry stems of all the leaves. The ground below the creeping stems and around clumps of grasses is strewn with pellets of castings of

the numerous larvae. Several detached paddocks in different localities in the area are affected almost simultaneously; while during an outbreak, the larvae, in all the foci of infestation, appear almost of the same age. Larvae march in all directions, unimpeded by roads, pathways or other obstructions. As is the case with cutworms in general, in all these outbreaks the density of the pest population subsides to surprisingly insignificant numbers during the course of a fortnight, but even in this short interval, much damage is done by mass feeding, and heavy loss in yield of hay is caused. If the damage happens to be during the tender stage of the grass, the hay for the season is shortened in length and its quality suffers.

The Adult Moth.

The adult moth is a dark brown stout insect. The forewings of the female are more lightly coloured than those of the male which are dusky black. The male is slightly smaller than the female whose abdomen is more stout and pointed. The end of the abdomen in the male is beset with a tuft of elongated scale like hairs, while the hairs in the female abdomen are short and less conspicuous.

The adult moths begin to emerge in the field at dusk; and when disturbed at the approach of a powerful light take to short haphazard flights. They rest on dry grasses near the place of emergence, and are scarcely visible during day time. At night they rise into the darkness with great rapidity. The longevity of male moths was found to be 3-10 days, with an average of 7.14 days for 14; for females it was 4-14 days, with an average of 9.45 for 22.

Egg laying Habits.

Eggs are generally laid about five to six days after emergence. In a series of observations made at the Insectary at Coimbatore, as many as 597 larvae constituted the progeny of a single female. The eggs are generally laid inside the leaf sheaths, a few may be found on open leaf tips, leaf folds, on stems, and occasionally in the laboratory cages; a few were scattered on the earth. The major portion of normal egg laying is confined to the space between stem and leaf sheath. The maximum number of eggs laid by a single female was 597, the minimum 110; with an average of 314-5 for 12. In one particular instance, 396 eggs were found in 43 clusters of which the distribution was as follows:—190 between stem and sheath, 72 in leaf folds, 118 on leaf, 7 on stem and 8 on soil. The eggs are laid in rows or in small clumps or masses, each row or group containing 2-19 eggs. A few isolated hairs are scattered in between, but the eggs are not covered by hairs. They are, however, protected to some extent by the sheath or fold of the leaf. Eggs are never found on tender leaves, but the larvae hatching out of them soon find a place on the tender regions of the plant.

Description of Stages.

Egg.—Each egg is roughly spherical in form measuring about $\frac{1}{2}$ mm., pale, creamy white in colour, with the surface smooth and shining. The eggs get a golden yellow tint just before hatching.

Larva—1st instar.—Newly hatched caterpillar about $2\frac{1}{4}$-$2\frac{1}{2}$ mm. in length. Head nearly as big as the body segments. Head shield pale glossy brown, prothoracic shield small, distinct and of the same colour as the head. Body slender, pale greenish, with whitish isolated hairs or setae. Viewed under high magnification, the setae on the body are seen to arise from minute black spots. Eye spots on the head shield brownish black, mandibles brownish. The larva exhibits looping movements though five pairs of prolegs are seen. The first pair of prolegs is least developed and look like minute stumps; the last three pairs well developed. The larva is able to lift the anterior portion of its body on its posterior three pairs of prolegs, the front

portion of the body remaining in a bent posture without touching the substratum. While moving on leaf, the portion of the body between thorax and abdominal segment 4 is bent upwards in a loop. Lines on the body are very feebly indicated towards the end of the stage. The first instar lasts 4-7 days.

2nd instar.—The larva about 5 mm. long. Head as big as body segments or slightly bigger, head shield pale transparent and shining, with faint brownish markings or lines; ocelli black; two brownish lines on head shields, closely approximated to each other towards the centre and diverging at the 'vertex' and basal portion of 'front', labrum and mandibles brownish, front and adfrontal areas whitish. Body with five black longitudinal lines on either side of the median dorsal whitish streak. These may be termed and are hereafter referred to as dorsal, subdorsal, lateral, sublateral, and ventrolateral lines. A few irregular brownish streaks visible below the ventrolateral lines. Legs and prolegs pale whitish, prolegs fully developed, outer side of each slightly chitinised and of lightly darker shade. Setae sparse, indistinct and short. The stomata appear as minute black spots. Ventral side of the body pale white or greenish white. With growth, the five lines on each side get a brownish tint and the body looks greenish brown. The abdominal segments become thicker by growth and the prothorax and head appear smaller in comparison.

Feeding commences one hour after moulting. During the instar, the larva, when at rest, keeps its anterior portion of the body raised up in a curve, the whole body resting on the posterior three pairs of prolegs. Larva when active makes looping movements. In cages, the 1st and 2nd stage larvae were found to feed also on flowers of grasses. The 2nd instar lasts 2-6 days.

3rd instar.—Brownish black markings on head shield more prominent. The formation of a thin black vertical short line in the centre of 'front' a characteristic and distinguishing feature. The outer side of the epicranium bears irregular brownish black mottlings. Body stouter and smooth from voracious feeding, lines on the body darker and modified, lateral line broader and modified. General colouring greenish, head and posterior ends brownish. Stomata seen as black spots slightly bigger than in the previous stage. Towards the end of the stage, the coloration becomes dull and there is a tendency for the transformation of the lines into bands incorporated by numerous striae.

The larva feeds actively on grass leaves and some of the larvae show very rapid growth and there is also a shortening of the length of the instar. Two more brown lines appear at the outer side of the epicranium on each side and these, descending in the region of the ocelli, enfold the latter. The third instar lasts 2-7 days.

4th instar.—The size in the beginning varies from 6 to 12 mm. when the head shield is as broad as the body segments. Brown lines on the head with the characteristic mottlings on the epicranium clearer and more accentuated, 'front', adfrontal area and its continuation upwards pale whitish and glossy, centre of 'front' with brownish black vertical streak. Prothoracic shield indistinct, prothoracic and anal shields whitish. Legs and prolegs pale white, ventral side of body greenish.

The coloration on body surface is changed materially. The intervening whitish spaces between black lines, of the previous stage, are reduced to very narrow imperceptible streaks of a yellow tinge or into irregularly mottled bands. Pinkish lines appear as transverse, border lines between segments. In continuation of the adfrontal whitish area and vertex, the median dorsal line of white tint, is seen as a very narrow streak in between the closely approximated two black dorsal lines. The subdorsal black line is now reduced to a pinkish faint black band, and below this a prominent yellow streak is formed anew. A lateral pinkish broad band appears in place of the lateral black line. Below this, a broad sublateral black band is formed by the coelescence of the sublateral and ventrolateral lines of the previous stage; the interspace between the two latter is merged and almost obliterated in the broadened band now formed. Ventral of this broad sublateral black band, a few irregular lines of yellowish tinge, now formed, appear as a distinct band, which is made more conspicuous during further growth and is studded with irregular pinkish patches

forming a line in its middle. During this stage the larva exhibits its most vivid coloration. There is great variation in minute details of lines and bands which defy description in individual larvae. The body grows more uniformly cylindrical and smooth. Setae are indistinct and a few are seen to arise from black tubercles. The spiracles are black and those in segments 3, 4 and 5 are seen in the yellowish ventrolateral band, while the others are placed in the black band above or in the border. Towards the end of the stage, the larva grows to about 20 mm. The general coloring turns greenish black, interspersed by pinkish and yellowish bands at the sides. The median dorsal whitish streak between the two dorsal lines is replaced by a pinkish brown band in the centre, the dorsal lines growing faint. The subdorsal line towards the end of the stage develops into a broad pinkish brown band bounded by a narrow clear yellow streak below formed of the interspace between the original subdorsal and lateral lines. The lateral line is now a broad reddish pink band bounded by an upper yellow streak and a lower whitish yellow streak. The sublateral and ventrolateral lines have completely coalesced obliterating the interspace totally. This band is black and conspicuous, in contrast to the yellowish pink area below which now forms the ventrolateral border. The fourth instar lasts 2-8 days.

5th instar.—The larva, to start with, is on an average 23 mm. long and 4.5 mm. broad. The general color pattern from being vivid and attractive tends to become dull. The larva is dusky grey or dull blackish. A central median dorsal blackish broad band, a lateral area or band constituted of yellow and black lines close together, and a sublateral thick distinct black band, bordered below by the ventrolateral dusky greenish area, are the characteristic stripes. Closely examined, all these are formed of numerous minute longitudinal striae. Some of the larvae show at the outer border of the median dorsal broad band, elongated black spots or thickenings over each segment, forming almost an interrupted straight line. The stout smooth larva, with dirty greenish grey color alternating with faint greyish pink bands and yellow striae, now resembles ***Spodoptera mauritia*** and displays the same habit of curling into a ring when disturbed. The larva grows to about 28-32 mm.; just before pupation even the light pinkish tinge vanishes, and it takes the color of the soil. The spiracles are vertically oval spots with a jet black elevated rim and pale dark central portion. Preparatory to pupation, the larva seeks the soil, when excepting head, and segments I and 10, all other segments are of uniform thickness and color. The black lines on the head and the characteristic vertical streak in 'front' are distinct. The head region is dull black due to the mottlings and lines. The black bands over the dorsal and sublateral regions fade into a grey tint, retaining the original black color, localised to linear spots, one over each segment. The pink color of the lateral and ventrolateral line is less conspicuous. In this condition the larva approaches Spodoptera in form and colour, the difference however being noticeable particularly in the coloration and markings of the head shield. In some larvae, the black color is retained but the numerous longitudinal lines fade and in such examples, the head is darker still. When feeding has ceased the larva in the soil, takes a curved posture inserting its head into the earth, the body color simulating the color of the soil or dry grass stems from amidst which it is scarcely visible. The fifth instar lasts 3-8 days.

Pupa.—The full-grown larva burrows into the soil, constructs a thin cell of earth within which it moults and pupates. The pupa is about 13 mm. long, brownish red or yellowish red. Two horny spines, projecting from the tip of abdomen tipped black, two smaller, thinner, curved spines or setae placed, one on each side, on the penultimate segment, close to the segment bearing terminal spines. At the posterior region of the abdomen there are two smaller vertical slits or thin short streaks, one in front of the other. Male pupa, yellowish brown, the anterior slit in the middle of an elevated flat swelling. Female pupa, brownish red, anterior slit not so prominent but flush with the surface. Slits black in both, posterior one darker and thicker. The pupae are found usually 1-3 inches below soil.

Under field conditions, in the course of investigations at Hosur grass lands the pupae were found in a variety of situations such as in soil in the middle of the paddock, sides of bunds, shady portions below trees, or close to tree

trunks, and also in between grass clumps which form a fibrous matting or meshwork just below surface layer of soil. Hard clayey soil as well as loose dry sandy situations are avoided; and the largest number of pupae were found in situations where the soil was moist enough for larvae to burrow in and the surface covered with dry matting of grass or mulch of dead leaves.

The Life Cycle.

The egg, larval and pupal periods were 4-5, 19-28 and 8-11 days respectively. The total period from egg to adult was about 32-43 days with an average of 36.48 days for 21 specimens, when larvae were reared in individual cages. In the case of bulk rearing, allowing batches of larvae to feed more freely and with ample scope for their activities, a few of each batch were found to reach the adult stage in a shorter period; in such cases, the period varied between 27-40 days with an average of 31.9 days for 14 series.

Habits of the Pest.

From observations made at Hosur pastures, where the pest outbreaks have been more or less of frequent occurrence, there are no evidences of pupae or larvae tiding over adverse seasons, as such. During 1937, the caterpillars in the field were enclosed by field cages for observation during May, and again in December. Wire gauze cages, $2\frac{1}{2}' \times 2\frac{1}{2}' \times 2'$, with one side open were inverted over the soil, the edges of the open end fitting closely on to grooves on a square frame of wood embedded in the soil so as to leave no hole or opening for the escape of the specimens from inside the soil. 200 larvae feeding on grass and in contact with soil below were under observation in four different situations in the farm, and the cage contents were examined in the subsequent months, allowing enough time for normal emergence. In such examinations of larvae in soil, there was no instance of a single larva or pupa surviving as such. The same course of observation was repeated during December the same year, leaving 300 larvae in one cage. So far, there is no record of an aestivating or hibernating stage for this insect. It is quite possible that the insect continues to breed all through the year, selecting different localities, far away from each other, for each brood. A long period of drought and depression followed by heavy flooding rains seems to be a favourable condition for the occurrence of severe outbreaks.

Natural Enemies.

Crows.—Crows congregate in numbers in plots infested by these caterpillars to devour them. The birds are seen in large numbers during the morning and late in the evening feeding on the caterpillars. When the grass is mowed the birds remain in the field throughout the day destroying a large part of larval population.

Ants have been noted destroying large numbers of pupae in soil, covered by field cages in the field. In spite of the depredations of ants a large number of pupae in the field survive to develop into moths.

Parasites.—During the outbreak of 1937, a large number of larvae and pupae were examined in the field for parasites. In the collections, there were three kinds of Tachinid parasites which have been identified as (1) *Actia monticola* Mall, (2) *Cyphocera varia* F, and (3) *Sturmia inconspicuoides* Bar. *Actia monticola* is a parasite of comparatively small size breeding as an internal parasite in the caterpillar which harbours more than one parasite-pupa inside its body. The caterpillar is killed before it pupates. *Cyphocera varia* is slightly bigger in size and moves out of the body of the full-grown caterpillar for pupation. The parasitic grub leaves the host just before the latter is about to pupate. The host larva barely survives for a day. *Sturmia inconspicuoides* is fairly big in size and invariably pupates inside the host. Some of the host caterpillars feed and pupate with the parasite inside, but are ultimately destroyed by the time the parasite emerges. The big-sized reddish brown pupa of the parasite is often seen through the thin skin of the host pupa. The extent of parasitisation was very small.

Control Methods Tried.

In the past, during times of large-scale damage to grass, several methods have been tried with a view to destroy the caterpillars, to minimise damage, or to prevent future outbreaks, but no satisfactory method has yet been evolved. Ramachandra Rao (1930) has recorded trials of dusting with Paris green and calcium arsenate on a small scale, but the treated hay was found on analysis to contain residue enough to make it unfit for fodder purposes. Baits and light traps were tried without success. Shielding, ploughing and burning of paddocks after the crop did not succeed in preventing future outbreaks and could not be carried out on an extensive scale. Crushing the larvae using stone rollers was first attempted by Ramachandra Rao (1930) and later, in 1937, with no appreciable success. Egg mass collection and destruction are impracticable, due to the habit of the moths of concealing the egg masses within sheaths of leaves and distributing the eggs in small clusters on several plants. By keeping close watch, by noting newly hatched or growing caterpillars during the pest season, some relief is likely to be achieved by preventing spread of the swarms from plot to plot. If the outbreak happens to occur towards the end of the year early harvesting of the crop minimises loss as well as spread of the pest.

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THE MEDICINAL AND POISONOUS PLANTS OF INDIA.

DAMMERS, GUTTIFERS, SILK-COTTONS, TEAS, TUTSANS, WATER-PEPPERS.

BY

J. F. CAIUS, S.J., F.L.S.

I

The DIPTEROCARPACEAE are all natives of the hot damp forests of India and Malaya, except a few African species. Many are among the biggest trees in the forests and are valued for their magnificent timber. Many also produce useful gums, and some yield a very good quality of camphor. The seeds are generally oleaginous. There are 25 genera with 350 species.

The medicinal and poisonous Dammers belong to 5 genera, all represented within our limits: DIPTEROCARPUS (Indo-Malaya); DRYOBALANOPS (Borneo, Malaya); HOPEA (Indo-Malaya); SHOREA (Ceylon to Philippine Islands); VATERIA (Seychelles, South India).

A. Calyx scarcely enlarged in fruit, segments reflexed ... VATERIA

B. Calyx much enlarged in fruit, segments erect.

1. Fruiting calyx with a distinct tube covering the fruit. Fruit free.
   a. Sepals developed into long wings, 4 ... ... DRYOBALANOPS
   b. Sepals developed into wings 2, the others very short ... ... DIPTEROCARPUS
2. Fruiting calyx with an obscure tube; aestivation of the calyx imbricate.
   a. Wings 3 long, 2 shorter ... ... SHOREA
   b. Wings 2 large, 3 small ... ... HOPEA

DIPTEROCARPUS.

The genus consists of 70 Indo-Malayan species.

Many species produce a valuable oleo-resin, known as wood oil, which is used in medicine.

The following are used in Dutch India—*D. gracilis* Blum., *D. littoralis* Blum., *D. retusus* Blum., *D. Spanoghei* Blum., *D. trinervis* Blum.—; in the Philippine Islands—*D. affinis* Brandis, *D. grandiflorus* Blanco, *D. pilosus* Roxb., *D. polyspermus* Blanco, *D. trinervis* Blum., *D. vernicifluus* Blanco—; in Indo-China—

D. alatus Roxb., *D. artocarpifolius* Pierre, *D. intricatus* Dyer, *D. Jourdainii* Pierre, *D. tuberculatus* Roxb., *D. turbinatus* Gaertn.—.

A. Calyx-tube in fruit without ribs or wings.
- 1. Young branches glabrous or canescent ... *D. turbinatus.*
- 2. Young branches more or less hairy ... ... *D. pilosus.*

B. Calyx-tube in fruit 5-angled or winged.
- 1. Angles confined to the upper portion of the calyx-tube ... ... *D. tuberculatus.*
- 2. Angles or wings prolonged to the base of the calyx-tube or nearly so.
  Angles winged ... ... *D. alatus.*

1. **Dipterocarpus alatus** Roxb. occurs in Chittagong, Burma, Tenasserim, the Andamans, Penang; extending to Siam and Indo-China.

In Cambodia the bark is considered tonic and depurative and prescribed in rheumatism. The bark of the young plant is used externally in rheumatism and in liver troubles. The oil is applied to ulcerated wounds.

In general the oleo-resin is applied externally in gonorrhoea.

Andamans: Gurjun—; *Bengal*: Battisal, Garjan, Shwetagarjan—; *Burma*: Kanyin, Kanyinbyu, Kanyinni, Kanyinwettaung—; *Cambodia*: Chhoeuteal, Trach—; *Chittagong*: Duliagurjan—; *Indo-China*: Chhoeu teal thom, Chhoeu teal tuc, Chor tuc, Dau con rai trang—; *Sinhalese*: Horagaha—.

2. **Dipterocarpus pilosus** Roxb. occurs in Sylhet, Chittagong, South Tipperah, Burma, Martaban, Mergui, the Andamans, the Malay Peninsula, and Siam.

The balsam is used in the treatment of gonorrhoea, gleet, and similar affections of the urinary organs.

Assam: Hollong—; *Tagalog*: Hagachac—.

3. **Dipterocarpus tuberculatus** Roxb. is distributed over Burma, Siam, and Cochin-China.

The oleo-resin is used with asafoetida and cocoanut oil as an application for large ulcers.

In Cambodia the roots are used in the treatment of hepatic troubles.

Burma: Eng, In Inbo, Kanyingok—; *Cambodia*: Khlong—; *Laos*: Mai bao, Mai tung—; *Siamese*: Mai rang—; *Taleing*: Sooahn—.

4. **Dipterocarpus turbinatus** Gaertn. f. occurs in Assam, Chittagong, Burma, the Andamans; extending to Siam and Cochin-China.

The oleo-resin is applied externally to ulcers, ring-worm, and other cutaneous affections. It is stimulant of mucous surfaces, particularly that of the genito-urinary system, and also diuretic. In gonorrhoea and other affections in which copaiba is generally employed, it has proved an effectual remedy.

Assam: Kuralsal, Kuroil, Tiliagurjan—; *Bengal*: Gurjan, Shwetagurjan, Tihyagurjan—; *Burma*: Inbo, Inkanyin, Kanyinbyu, Kanyingyi, Kanyinni, Kanyinnin, Kanyinwettaung, Kanyinwettaw, Kanyinywetgyi, Kanyinywetthe,

Maihow—; *Canarese*: Challane, Guge, Valivara—; *Chittagong*: Kaligurjan, Teliagurjan, Tiliagurjan—; *English*: Wood Oil Tree—; *Gujerat*: Gurjun—; *Magahi*: Kanyoung—; *Tagalog*: Mayapis—.

Dryobalanops.

The genus consists of 7 species, natives of the Malay Peninsula and Islands.

Dryobalanops aromatica Gaertn. inhabits the forests and lowlands on low hills of the Malay Peninsula and Archipelago.

The tree produces camphor oil and camphor, much used as a tonic and sudorific. The camphor is chiefly exported to China, where it is employed as a tonic and aphrodisiac; in Borneo itself it is used as a diuretic and in nephritic affections, and as a popular remedy for rheumatism.

China: Lung Nao Hsiang—; *Indo-China*: Camphrier de Baroum, Camphrier de Barros, Camphrier de Bornéo, Long nao thu, Ping pien—; *Malay*: Kapur barus—.

Hopea.

This genus numbers 50 Indo-Malayan species.

Hopea odorata Roxb. occurs from Pegu and Tenasserim to Cochin-China. It is also found in the Andamans.

In Cambodia the bark is used as an astringent in gingivitis.

Among the Burmese the resin, reduced to powder, forms a popular styptic.

Andamans: Rimda—; *Burma*: Thengan—; *Cambodia*: Koki—; *Lao*: Mai takien—.

Shorea.

This genus numbers 90 species spread from Ceylon to the Philippine Islands.

All the species abound in various kinds of copalline resins.

The following are used medicinally:—in the Philippine Islands—*S. Guiso* Blum., *S. malaanonan* Blum., *S. mangachapuy* F. Vill.—; in Cambodia—*S. cambodiana* Pierre, *S. Harmandii* Pierre.

The oil from the seeds of *S. stenoptera* Buck is officinal in Holland. The resin from S. Wiesneri Stapf. and various other species are officially recognized in Austria, Russia, and Spain.

Stamens 20-∞.

1. Leaves 15-25 by 10-15 cm. Petiole 2-2.5 cm. ... *S. robusta.*
2. Leaves 6.3-20 by 3.2-11.5 cm. Petiole 2.5-5 cm. *S. Tumbuggaia.*

1. **Shorea robusta** Gaertn. f. occurs in the Kangra district of the Punjab, from the Kalesar forest in the Ambala district along the sub-Himalayan tract to the Darrang district of Assam,

sometimes in the outer Himalayan valleys up to 5,000 feet; in the Garo Hills, Kamrup, the Khasia Hills, the Jaintia Hills, from the Santal Parganas through Chota Nagpur and Orissa to Ganjam, Jeypore, the Central Provinces, Vizagapatam.

Ayurveda practitioners freely prescribe the bark, leaves, fruit, and resin. Among Yunani doctors the resin and the oil seem to be more especially favoured.

The resin is regarded as astringent and detergent. It is used in dysentery, and for plasters and fumigations. It is commonly given for weak digestion, gonorrhoea, and as an aphrodisiac.

Arabic: Kaikahr—; *Bengal*: Sakher, Sakhu, Sakhua, Sakoh, Sal, Sala, Salwa, Sarj, Shal—; *Bhumij*: Sargi—; *Bombay*: Sal—; *Burma*: Enkhyen—; *Canarese*: Asina, Asu, Ashvakarna, Guggula, Kabbu, Sarja, Vamsa—; *Central Provinces*: Rinjal, Sal, Sarai—; *Deccan*: Ral—; *English*: Common Sal, Indian Dammer, Sal Tree—; *Garhwal*: Kandar—; *Garo*: Bolsal—; *Gujerati*: Ral—; *Hindi*: Sakher, Sakhu, Sakhua, Sakoh, Sal, Sala, Salwa, Shal—; *Kharwar*: Sakwa—; *Khond*: Jargi—; *Kolami*: Sarjum, Sekura—; *Kumaon*: Sal—; *Lepcha*: Takral, Teturl—; *Malayalam*: Maramaram, Mulappumarutu—; *Marathi*: Guggilu, Rala, Sajara—; *Nepal*: Sakwa—; *North-Western Provinces*: Kandar, Koron, Sakhu, Sal—; *Oudh*: Koroh—; *Persian*: Lalemoabbari, Lalemohari—; *Punjab*: Sal, Seral—; *Sanskrit*: Agnivallabha, Ashvakarna, Ashvakarnika, Chiraparna, Dhanya, Dirghaparna, Dirghashakha, Divyasara, Jaladashara, Jaranadruma, Kala, Kalalajodhbhava, Karshya, Kashayi, Kaushika, Kaushikahva, Kushika, Lalana, Latashankha, Latataru, Rala, Ralakarya, Sala, Salaniryas, Salaveshta, Sarja, Sarjakarya, Sarjarasa, Sarjjaka, Sasyasambara, Sayasamvera, Shankataru, Shankurriksha, Shasyasambara, Shura, Sidhaka, Sureshtaka, Tarkshyaprasava, Vallivriksha, Vansha, Vastakarna, Yakshadhupa—; *Santal*: Sarjom—; *Sinhalese*: Dammala—; *Tamil*: Attam, Kungiliyam, Shalam—; *Telugu*: Gugal, Guggilamu, Saluva, Sarjakamu, Sarjamu—; *Tharu*: Sakwa—; *Uraon*: Sekwa—; *Urdu*: Ral—; *Uriya*: Rengal, Sagua, Salo, Salwa, Shalua, Sodingi, Soringhi, Sorjjo—.

2. **Shorea Tumbuggaia** Roxb. is found in the forests of the Cudappah, North Arcot, and Chingleput hills, up to 3,000 feet.

The resin is used as an external stimulant.

English: Green Dammer—; *Malayalam*: Tampakam—; *Tamil*: Karundanbai, Karuppudamar, Tambagam, Tambai, Tambugai—; *Telugu*: Guggilamu, Jalari, Nalladammara, Nallaguggilamu—.

VATERIA.

The genus consists of 3 species confined to South India and the Seychelles.

Vateria indica Linn. is found from North Kanara to Travancore up to 3,500 or 4,000 feet, chiefly in evergreen forests, but occasionally along rivers in deciduous forests. In Coorg both in the Ghat forests and east of the Ghats up to 3,500 feet, in the latter locality always in evergreen forest.

The fruit yields a solid fatty oil, which has obtained considerable repute as a local application in chronic rheumatism and some other painful affections.

Under the influence of gentle heat, the resin combines with wax and oil and forms an excellent resinous ointment; it is a good

substitute for officinal resin. Fine shavings are administered internally to check diarrhoea.

Arabic: Mukilijraka—; *Bengal*: Chundrus—; *Bombay*: Ral—; *Canarese*: Bilidhupa, Biliguggula, Dhupa, Dhupada, Dupa, Guggula, Maddidhupa, Mandadupa, Rala, Shandike—; *Ceylon*: Pinai—; *Coorg*: Bilidupa—; *Deccan*: Sufeddamar—; *English*: Indian Copal Tree, Piney Varnish Tree, White Dammer Tree—; *Greek*: Sandaraki—; *Hindi*: Kahruba, Sageddamar, Sandras—; *Malayalam*: Kunturukkam, Pantam, Payani, Payin, Perumpayani, Telli, Vellakkunturukkam—; *Persian*: Buejhudan—; *Sanskrit*: Ajakarna, Dhupa, Kundura, Mandadhupa, Marichapatraka, Pitaphada, Sarjaka, Shala—; *Sinhalese*: Hal, Haldumula—; *Tamil*: Attam, Kukkil, Kukkulu, Kundurukkam, Kungiliyam, Kungulu, Sadagulai, Tubam, Vellaikkundurukkam, Vellaikkungiliyam—; *Telugu*: Dupadamaru, Telladamaru, Tellaguggilamu—; *Tulu*: Lobhana, Paini, Tandoligeda—; *Urdu*: Guggul—.

II

The GUTTIFERAE are trees or shrubs with a resinous yellow or greenish juice. Except a few natives of the warm regions of North America, they are all intertropical; they are more numerous in America than Asia, and are comparatively rare in Africa. There are 40 genera with about 630 species.

The members are the source of gum resins endowed with emetic and cathartic properties. The seeds are mostly oleaginous and the oils and fats are used medicinally. Some of the barks are diuretic. The rind of the fruit may be astringent.

Among the gum-resins gamboge may be mentioned as containing α—, β—, and γ— garcinolic acids.

An essential oil was found to consist of terpene and camphor.

Cambogin, a toxic resin, has been obtained from *Garcinia cambogia* Desr.

The medicinal and poisonous Guttifers of the world belong to 11 genera: ALLANBLACKIA (tropical Africa); CALOPHYLLUM (tropics, chiefly Old World); CLUSIA (warm America); GARCINIA (tropical Asia, Africa, and Polynesia); MAMMEA (West Indies); MESUA (tropical Asia); MORONOBEA (Guiana, North Brazil); OCHROCARPUS (palaeotropical); PENTADESMA (Western tropical Africa); RHEEDIA (tropical America, Madagascar); SYMPHONIA (Madagascar, tropical Africa and America).

The medicinal Guttifers of India belong to 4 genera: CALOPHYLLUM, GARCINIA, MESUA, OCHROCARPUS.

A. Ovary-cells 1-ovuled; stigma sessile or subsessile, peltate, entire or with radiating lobes; berry indehiscent.
 1. Calyx of 4 or 5 sepals ... ... GARCINIA.
 2. Calyx closed in bud, bursting in 2 valves ... OCHROCARPUS.

B. Ovary with 1, 2, or 4 erect ovules; styles slender (rarely styles 2); stigma peltate or 4-fid or acute; fruit fleshy, rarely dehiscent.
 1. Ovary 1-celled, 1-ovuled, style 1, stigma peltate CALOPHYLLUM.
 2. Ovary 2-celled, 4-ovuled, style 1, stigma peltate MESUA.

CALOPHYLLUM.

The genus consists of 80 tropical species, mostly inhabiting the Old World.

The bark is diuretic; the resin is emetic and cathartic.

The following species are used medicinally: in China, Indo-China, and the Islands of the Indian Ocean—*C. inophyllum* Linn.—; in Madagascar— *C. laxiflorum* Drake, *C. parviflorum* Bojer, *C. Tacamahaca* Willd.—; in the West Indies—*C. Calaba* Jacq.—; in Brazil—*C. brasiliense* Camb.—; in Colombia—*C. Calaba* Jacq., *C. Mariae* Pl. and Tr.—.

1. Leaves 10-20 by 7.5-10 cm., petiole 3.8-3.2 cm. ... *C. inophyllum.*
2. Leaves 7.5-12.5 by 3.2-5 cm.; petiole 13-20 mm. ... *C. elatum.*
3. Leaves 5-10 by 3.2-5 cm.; petiole 4 mm. ... *C. apetalum.*

1. **Calophyllum apetalum** Willd. occurs in the Western Ghats of the Bombay Presidency, and from Mysore to Travancore up to 1,000 feet; on the banks of rivers and backwaters on the West Coast from North Kanara southwards.

The resin acts as a vulnerary resolvent, and anodyne.

The oil obtained from the seeds is used as medicine in leprosy and cutaneous affections, and in infusion, mixed with honey, in scabies and rheumatism.

Bombay: Cherupinnai, Sarapuna—; *Canarese*: Babbe, Bobbe, Bobbi, Irai, Iria, Kalhonne, Kalpun, Kirihonne, Kullponne—; *Marathi*: Bobbi, Irai—; *Tamil*: Sirubinnai—; *Travancore*: Attupunna, Kattapunna, Mannapunna, Purapunna, Serupunna—; *Tulu*: Kaiponne, Kalponne, Seruponne, Siriponne—.

2. **Calophyllum elatum** Bedd. is found in the evergreen forests of the Western Ghats, and adjoining hills, from South Kanara to the Pulneys.

The gum is feebly astringent.

Bombay: Pun, Sirpon—; *Canarese*: Bobbi, Holehonne, Kuve, Siripunehuve, Siripunekuve, Siruponne, Srihonna, Surponnebobbi—; *English*: Malabar Poon, Poon Tree, Sirpoon Tree—; *Kadir*: Karanguttiyan, Viri—; *Malayalam*: Kattupunna, Malampunna, Pun, Pungu, Punna, Punnappai—; *Marathi*: Nagani—; *Sinhalese*: Kina—; *Tamil*: Kattupinnai, Pinnai, Pongu, Pungu—; *Tulu*: Pune—.

3. **Calophyllum inophyllum** Linn. is essentially a littoral species to be found along the East and West coasts of the Peninsula, Burma, the Andamans, Malaya, and Ceylon. It is distributed to the sea-shores and the islands of East Africa, Australia, and Polynesia.

The bark is astringent and useful in internal haemorrhages. The juice is used as a purgative, and is said to be very powerful in its action.

In Java the tree is supposed to possess diuretic properties.

In Cambodia the leaves are prescribed as an inhalation in migraine and vertigo. The oil from the kernels of the seeds is used in scabies.

The leaves, soaked in water, are employed as an application to inflamed eyes, in the Malay Archipelago.

In Madagascar the leaves are applied to sore eyes; the pounded bark is used topically in orchitis; the gum resin is considered vulnerary, resolvent, and anodyne; the oil from the seeds is a

reputed antisoric, and is much used in the treatment of rheumatism; a decoction of the root is used in dressing ulcers.

The tears which distil from the tree and its fruit are emetic and purgative (Rheede).

The gum which flows from the wounded branches, mixed with strips of the bark and leaves, is steeped in water, and the oil which rises to the surface is used as an application to sore-eyes. It is said to be a useful remedy for indolent ulcers.

In New Caledonia the gum resin is applied to ulcerous wounds.

The fixed oil, expressed from the kernels of the seeds, is said to cure scabies. It exercises a great beneficial influence over the mucous membrane of the genito-urinary organs, and is therefore highly useful in the treatment of gonorrhoea and gleet. Externally, it is a good and useful embrocation in rheumatism and gout. The watery paste of the kernel of the seeds, applied to the painful joints and dried by the heat of fire, often affords a great relief in the same diseases, and may be resorted to in the absence of the oil.

Bengal: Punnag, Sultanachampa, Sultanachampaca—; *Betsileo*: Foraha—; *Betsimisaraka*: Forho—; *Bicol*: Dancalan—; *Bombay*, Udi, Undi—; *Burma*: Pengnyet, Phounniya, Phungnyet, Ponnyet, Pungnyet—; *Cambodia*: Kchyuong—; *Canarese*: Honne, Huhonne, Nameru, Pinnaikai, Ponne, Surahonne, Vuma, Wuma—; *Ceylon*: Domba, Dommakkottai, Punnai—; *Chinese*: Hu T' ung Lei—; *Cutch*: Udi—; *Deccan*: Surfan, Surpanda, Undi—; *English*: Alexandra Laurel, Alexandrian Laurel—; *Fiji*: Dilo—; *Guam*: Daog, Daok—; *Hawaii*: Ramani, Kamanu—; *Hindi*: Sultanachampa, Surpan, Surpunika, Undi—; *Hova*: Tsindelo—; *Ilocano*: Bitaog, Bitog, Pamitaoguen, Pamitlaten—; *Indo-China*: Ho dong, Mu u—; *Konkani*: Unddi—; *Madagascar*: Foraha, Vintanina—; *Malay*: Betan, Bintangor bunga, Penaga laut, Pudik—; *Malayalam*: Pouna, Punna—; *Marathi*: Nagchampa, Puniag, Surangi, Undag, Undela, Undi, Wundi—; *Mauritius*: Bois Tacamaca—; *New Caledonia*: Pit, Tamanu, Vara—; *Oceania*: Ndilo—; *Pampangan*: Bitaog, Palomaria—; *Philippines*: Birog, Bitanhol, Bitoc, Dingcalin, Palomaria de playa, Tamanian, Vitam—; *Rarotonga*: Tamanu—; *Samoa*: Fetau—; *Sanskrit*: Nagachampa, Nameru, Punnaga, Purosakeshara, Surangi, Tungakeshara—; *Seychelles*: Takamaka—; *Sind*: Duggerphul, Dugurphort, Purraya, Purreya, Surangi, Undi—; *Sinhalese*: Domba, Dombagaha, Dombatel, Teldomba—; *Spanish*: Palo Maria, Palo de Santa Maria—; *Tagalog*: Bancalan, Bitanhol, Dancalan, Dincalin, Palomaria, Tamanian—; *Tahiti*: Tamanu—; *Taimoro*: Voakotry—; *Tamil*: Nagam, Nameru, Pinnai, Punnagam, Punnai—; *Telugu*: Nameru, Pouna, Punnaga—; *Tongking*: Cay mu hu—; *Tulu*: Ponne—; *Uriya*: Polang, Punang, Punnango—; *Visayan*: Bitaog, Dancalan—; *Zambales*: Bitaoi—.

GARCINIA.

The genus numbers 200 species scattered over the tropical regions of the Old World.

Astringent properties are met in the bark and in the rind of the fruit of some species. The gum resins are powerful, drastic cathartics.

The following are used medicinally:—in China—*G. Mangostana* Linn., *G. Morella* Desc.—; in Indo-China—*G. Hanburyi* Hook, f., *G. Mangostana* Linn.—; in Cambodia—*G. Harmandii* Pierre, *G. Lanessanii* Pierre, *G. Mangostana* Linn., *G. Olivieri* Pierre, *G. Vilersiana* Pierre—; in Malaya—*G. dulcis* Kurz., *G. Mangostana* Linn.—; in the Philippine Islands—*G. Mangostana* Linn., *G. spicata*

Hook. f., *G. venulosa* Chois.—; in New Caledonia— *G. corallina* Vieil.—; in West Tropical Africa—*G. Conrauana* Engl., *G. Elliotii* Engl., *G. gnetoides* Hutch. and J. M. Dalz., *G. guineensis* Willd., *G. Kola* Heckel, *G. Mannii* Oliv., *G. ovalifolia* Oliv., *G. polyantha* Oliv.—; in Southern Africa— *G. Livingstonii* T. And.

A. Sepals and petals 4 each.

1. Stigma entire. Stamens of male flowers in a globose central mass ... ... *G. atroviridis*.
2. Stigma divided into rays, or deeply 4-lobed.

I. Stamens of male flowers in 4 masses or in a 4-lobed mass surrounding the rudimentary ovary; anthers oblong, dehiscing vertically.

a. Leaves 15-25 cm. ... ... *G. Mangostana*.

b. Leaves 10-15 cm. ... ... *G. cornea*.

II. Stamens of male flower in a central shortly-stalked 4-angled or columnar mass; anthers quadrate, dehiscing vertically; rudimentary ovary usually absent.

Male flower in 3-∞-flowered, terminal and axillary fascicles; fruit subglobose or ovoid, tip mamillar.

a. Leaves 6.3-9 cm. ... ... *G. indica*.

b. Leaves 7.5-12.5 cm. ... ... *G. Cowa*.

III. Stamens of the male flowers in a subglobose mass; anthers adnate, orbicular, dehiscence circumsciss, rudimentary ovary absent.

a. Leaves 10-15 by 3.8-7.5 cm. ... ... *G. Morella*.

b. Leaves 15-20 by 7.5-10 cm. ... ... *G. heterandra*.

B. Sepals and petals 5, very rarely 4; filaments connate in 5, rarely 4 erect distant pedicelled spathulate bodies, antheriferous at the top, free portions very short.

I. Leaves 23-45 by 5-10 cm. long ... ... *G. xanthochymus*.

II. Leaves 12.5-25 cm. long ... ... *G. dulcis*.

1. **Garcinia atroviridis** Griff. is found in Upper Assam, at Tabong, in Singapore, Johor, Malacca, Perak, and Penang.

The fruit is used medicinally by the Malays.

Malay: Asam gelugur—.

2. **Garcinia cornea** Linn. is found from East Bengal to Tenasserim, whence it extends to the Malay Archipelago.

The tree yields an inferior kind of gamboge used medicinally in Burma.

3. **Garcinia Cowa** Roxb. occurs in Eastern Bengal, Assam, the Eastern Peninsula, and the Andaman Islands.

The gum-resin is used medicinally by Burman practitioners.

Bengal: Kowa—; *Burma*: Madow, Taungthale, Toungdalai—; *Hindi*: Cowa—; *Ho*: Soroa—; *Uriya*: Sarbana—,

4. **Garcinia dulcis** Kurz is found cultivated in the Malay Peninsula. It is distributed to the Malay Islands.

The oily seeds are sold in the drug shops of Malaya as a remedy for dysentery and chronic diarrhoea.

Malay : Bijimundu, Mundu—.

5. **Garcinia heterandra** Wall. is found in Pegu and Tenasserim up to 4,000 feet.

The gum-resin is occasionally, though not extensively, employed as a medicine by Burman native practitioners.

Burma : Thanatdau, Thanattau—.

6. **Garcinia indica** Chois. is often cultivated; it is found in Konkan, North Kanara, Goa, the Western Ghats of Bombay, South Kanara, Coorg, and Wynaad.

The fruit, either green or ripe, is much used by Ayurveda practitioners.

The Apothecaries of Goa prepare from the juice of the fruit a very fine purple syrup, which is used in bilious affections. The bark is astringent, and the young leaves, after having been tied up in a plantain leaf and stewed in hot ashes, are rubbed with cold milk and given as a remedy for dysentery.

The oil of the seeds is much used for the preparation of ointments, suppositories and other pharmaceutical purposes. It has been used as a local application to ulcerations, fissures of the lips, hands, etc., by partly melting it and rubbing on the affected part.

Bombay : Kokam—; *Canarese* : Ambsol, Dhupadamara, Murgala, Murginahali, Tittidika—; *Deccan* : Kokamb, Ratambi—; *English* : Wild Mangosteen—; *Goa* : Brindao, Brindoeiro—; *Gujerati* : Kokam—; *Hindi* : Kokam—; *Konkani* : Birondd, Birondi, Ratambi—; *Malayalam* : Punampuli—; *Marathi* : Amsole, Bhirand, Chirand, Katambi, Kokam, Kokamb, Ratambe—; *Matheran* : Kokam, Ratamba—; *Sanskrit* : Amlabija, Amlapura, Amlashaka, Amlavriksha, Amlavrikshaka, Atyamla, Bijamla, Chudamla, Chukra, Chukramla, Chukraphala, Phalamlaka, Puramla, Raktapuraka, Rasamla, Shakamla, Shreshthamla, Tintidika, Tittidiphala, Vrikshamla—; *Tamil* : Murgal—; *Tulu* : Puranapuli—.

7. **Garcinia Mangostana** Linn. is cultivated on the Western Coast of the Madras Presidency, the Nilgiris, in Goa, but very rarely in the Bombay Presidency. It is also cultivated all over the Malay Peninsula.

According to Rumphius, the bark and young leaves are employed by the Macassars in diarrhoea, dysentery and affections of the genito-urinary tracts, and also as a wash for aphthae of the mouth.

In Cambodia the bark of the plant and the rind of the fruit are used as astringents in dysentery and diarrhoea.

The rind of the fruit is a well-known astringent useful in the treatment of diarrhoea and dysentery. Waring and others have strongly recommended its use in chronic diarrhoea of children. It has also been employed successfully as a febrifuge. A very strong decoction is also recommended as an external astringent application.

The powdered rind of the dried fruit in daily doses of 60-120 grains dispensed in 3-4 portions gave satisfactory results in 63.8 per cent of amoebic—36 treated—and 66.6 per cent cases of non-amoebic—15 treated—dysentery, and in 72.0 per cent cases of diarrhoea other than dysentery—45 treated—. Mangostin was extracted from the dried rind and tried clinically. It was found to be very inferior to the powdered rind as an antidiarrhoeal agent (Caius and Mhaskar).

Bengal : Mangustan—; *Bombay* : Mangostin, Mangustan—; *Burma* : Mangkob, Mengkop, Mengut, Mimbu, Mingut, Youngzalai—; *Cambodia* : Mongkhut—; *Chinese* : Shan Chu Kuo, Tu Nien Tzu—; *English* : Mangosteen—; *French* : Mangoustan cultivé—; *Hindi* : Mangustan—; *Indo-China* : Mang cut, Mung khut—; *Jolo* : Manguis—; *Malaya* : Manggis, San chook hok—; *Malayalam* : Manggusta, Sulampuli—; *Marathi* : Mangastin—; *Portuguese* : Mangosta—; *Sinhalese* : Mangus—; *Spanish* : Mangostan, Mangostan de la India—; *Tamil* : Sulambuli—.

8. **Garcinia Morella** Desrous. occurs in Eastern Bengal and the Khasia Hills; in the evergreen forests of North Kanara and the Western Ghats, from South Kanara and Mysore to Travancore, up to 3,000 feet; in Ceylon, Malacca, Singapore, and Siam.

The gamboge is considered a valuable hydragogue cathartic. It also possesses anthelmintic properties. It is used in dropsical affections, amenorrhoea, obstinate constipation, and as a vermifuge.

The stem rubbed with water is a household remedy as a local application to rising pimples and boils, and often cuts them short.

Bengal : Tamal—; *Burma* : Thamengut—; *Canarese* : Aradala, Arasinagurse, Devanahuli, Jarize, Jarigehuli, Kankutake, Kankutgal, Punarapuli—; *Ceylon* : Korakkappuli, Makki—; *Chinese* : T'eng Huang—; *English* : Gamboge Tree—; *Hindi* : Tamal—; *Kadir* : Sikiri—; *Malayalam* : Daramba, Karukkampuli, Makki, Pinnarpuli, Pulinjakka, Valakkanna, Valogam—; *Marathi* : Tamil—; *Sanskrit* : Amritadruma, Kalaskandha, Kalatala, Lokaskandha, Mahabala, Niladvaja, Nilatala, Tama, Tamala, Tapichcha, Tapinja, Tapitha—; *Sinhalese* : Gokatu, Kanagoraka, Kanogoraka, Kokatiya—; *Tamil* : Irevalsinni, Makki, Solaipuli—; *Telugu* : Pasupuvarne, Revalchinni—; *Tulu* : Jarige, Jarigepuli, Kanakotekay—.

9. **Garcinia xanthochymus** Hook. f. occurs in Eastern Bengal and Eastern Himalaya, Burma, Penang, the Andamans, the Northern Circars, Ganjam, the Western Peninsula on the Ghats from Bombay to North Kanara, Mysore, Coorg, the Nilgiris and North Travancore up to 3,500 feet.

The fruit, which is yellow and of the size of a small apple and very acid, sweetish when ripe, edible, is used for the same purposes as that of *G. indica;* it is dried and made into a kind of Amsul. A sherbet made with about 1 oz. of the Amsul, with a little rock-salt, pepper, ginger, cumin and sugar, is administered in bilious conditions.

Assam : Tepor, Tezpur, Tihur—; *Bengal* : Chalate, Dampel, Tamal—; *Bombay* : Dampel, Onth, Osth—; *Burma* : Madau, Matau—; *Canarese* : Devangi, Deavkai, Devagarige, Devajarige, Divarige, Gansargi, Gurse, Hirekanigu, Janagi, Javangi, Neralemavu—; *Ceylon* : Egg-tree, Simaigoraka—; *Coorg* : Divarige, Nelamavu, Vate—; *Garo* : Manhola—; *Gujerat* : Karamala,

Ota—; *Hindi*: Dampel, Ota, Tamal—; *Kadir*: Anavaya—; *Konkani*: Dharambe—; *Lao*: Mai dah—; *Marathi*: Jharambi, Ota—; *Sanskrit*: Avika, Bhavana, Bhavishya, Bhavya, Kalakhanda, Kusumodar, Lamphala, Pichchalabija, Samputanga, Tamala, Tapinjha, Vakrashodana—; *Saora*: Lollorimanu—; *Sinhalese*: Cochingoraka, Ratagoraka—; *Tamil*: Kulavi, Malaippachai, Malaippuli, Pachilai, Pachumbadi, Tabinjam, Tamalam—; *Telugu*: Ivarumamidi, Sikatimramu, Sitakamraku, Tamalamu—; *Tulu*: Jarige—; *Uriya*: Cheoro, Chiuri, Sitambu—.

Mesua.

The genus consists of 3 species, natives of tropical Asia.

Mesua ferrea Linn. occurs in the mountains of Eastern Himalaya and Eastern Bengal, Assam, Tenasserim, Burma, the Andamans; in the evergreen rain-forests of North Kanara and South Konkan; in the forests of the Western Ghats from South Kanara to Travancore, up to 5,000 feet; and in Ceylon.

The bark and roots are considered to be, in infusion, an excellent tonic bitter.

The bark is mildly astringent and feebly aromatic. Combined with ginger it is given as a sudorific.

The flowers are astringent and stomachic. In many localities they are used for cough, especially when attended with much expectoration. A paste made of the flowers with butter and sugar is used in bleeding piles and burning of the feet.

In North Kanara and Bengal the oil of the seeds is used as an embrocation in rheumatism, and found useful in the treatment of itch. It is also employed as an antidote for snake poison.

The unripe fruits of this plant are aromatic and sudorific. The flower buds are used in dysentery. A syrup of flower buds 1 in 10 was used in acute cases of dysentery in the out-patient department; mild cases were cured by its use, but in very acute and severe cases, it was found to be inefficacious (Koman).

The leaf and the flower are among the best snake remedies of Ayurveda, and they are still very much used in Bengal as an antidote to snake and scorpion venoms. But Caius and Mhaskar have shown experimentally that no part of the plant is an antidote to either snake or scorpion venom.

Assam: Nahor—; *Behar*: Nagkeshur—; *Bengal*: Nagesar, Nagkesar—; *Bombay*: Nagchampa, Thorlachampa—; *Burma*: Gangau, Kangau—; *Canarese*: Kanchana, Kasara, Nagachampa, Nagakesara, Nagasampage, Nagasampige—; *Ceylon*: Naka—; *Coorg*: Atta, Iruppumara—; *Deccan*: Nagchampa—; *English*: Ceylon Iron-wood, Ironwood of Assam—; *French*: Arbre de fer, Bois d'anis, Bois de fer—; *Hindi*: Naghas, Nagkesar—; *Indo-China*: Thiet luc moc, Vap—; *Kadir*: Peri, Suruli—; *Konkani*: Nagchampa—; *Magahi*: Kainggo—; *Malay*: Matopus, Penaga kunyet, Penaga lilin, Penaga patih, Penaga sabat, Penaga suga—; *Malayalam*: Nágachempakam, Nanga, Peri, Vainavu, Veluttachempakam, Veluttapala—; *Marathi*: Nagachampa, Nagchampa, Nagchampha, Nagchapha—; *Michi*: Nahshor—; *Persian*: Narmishka—; *Pulaiya*: Atuponnai—; *Punjab*: Nagkesar—; *Sanskrit*: Bhujangakhya, Champeya, Hema, Hemakinjalka, Ibhakhya, Kanchana, Kanchanavhaya, Kanakavhaya, Kesara, Keshara, Kinjalka, Mahaushadha, Naga, Nagakeshara, Nagakhya, Nagakinjalka, Nagapushpanaga, Nagaya, Phalaka, Phanikeshara, Pinjara, Sunnagakeshara, Pushparachana, Bajapushpa, Rukma, Shatapadapriya, Suvarna, Suvarnakhya,

Svaraghatana—; *Sind*: Nakesuru—; *Sinhalese*: Deyana, Na, Nagaha—; *Tagalog*: Malabocboc, Malabucbuc—; *Tamil*: Irul, Karunangu, Malainangu, Mannainangu, Naganchambagam, Nagappu, Nagesuram, Nangu, Nirnangu, Patai, Pudangoli, Sirunagappu, Tadinangu—; *Telugu*: Gajapushpamu, Kesaramu, Kinjalkamu, Nagachampakamu, Nagakesaramu, Sikatimanu, Suvarnamu—; *Tinnevelly*: Nang—; *Tulu*: Kesara, Nagasampai—; *Urdu*: Narmishka—; *Uriya*: Nageshvar, Nageshvoro, Nagokesoro—.

OCHROCARPUS.

The 10 species of this genus inhabit the tropical regions of the Old World.

O. pentapetalus Blanco is used medicinally in the Philippine Islands, *O. Harmandii* Pierre in Indo-China, and *O. africanus* Oliv. in Tropical West Africa.

Ochrocarpus longifolius Benth. and Hook. fil. occurs in the Western Ghats of the Konkan, North Kanara, Malabar and Coimbatore; it is cultivated in the Northern Circars.

The flower-buds possess astringent and aromatic properties. They are used as a tonic in Persia.

The flowers are stimulant and carminative, useful in some forms of dyspepsia and in haemorrhoids.

Bengal: Nagakesar Punnangachcha, Rajachampaka—; *Bombay*: Suringi, Tambranagkesar—; *Canarese*: Gadhavunate, Phatapale, Punay, Puniye, Punnaga, Suragi, Surgi, Surungi, Unate, Wundy—; *Deccan*: Gardundi—; *Gujerat*: Punnaga, Ratinagkesar, Surapunnaga—; *Hamadan*: Normush—; *Hindi*: Nagkesar, Pulaga, Punnaga, Sultanachampaka—; *Konkan*: Ramundi, Suringi, Surong, Surongi—; *Malayalam*: Surampurna—; *Marathi*: Godiyundina, Punnag, Suringi, Undali—; *Matheran*: Godundipuwag, Harkia, Satwin, Surangi—; *Persian*: Nagkeshur, Tambra—; *Sanskrit*: Aruma, Devavallabha, Kamboge, Kesari, Keshara, Keshava, Kumbhika, Nagakeshara, Nagapushpa, Pandunaga, Pataladruma, Punnaga, Purusha, Purushakhya, Raktakeshara, Raktapushpa, Raktarenu, Raktavriksha, Surangi, Tunga— *Tamil*: Surabunnagam, Surabunnai, Valai—; *Telugu*: Suraponna, Surapunnagamu—; *Uriya*: Churiana, Surongo—.

III

The BOMBACACEAE number about 150 species grouped in 21 genera. They are all arborescent, and principally tropical, and include some of the largest trees.

Medicinal properties are exhibited by members of 4 genera: ADANSONIA, BOMBAX, CEIBA, PACHIRA. The last named is not represented in India.

A. Calyx 5-cleft ... ... ADANSONIA.

B. Calyx truncate or irregularly 3-5-lobed.

I. Branches of the staminal tube 1-antheriferous ... BOMBAX.

II. Branches of the staminal tube 2-3 antheriferous ... CEIBA.

ADANSONIA.

This genus consists of 10 species inhabiting the tropics of the Old World.

A. digitata is used medicinally in whatever country it is found growing. *A. Grandidieri* Baill. and *A. Za* Baill. are similarly used in Madagascar, *A. madagascariensis* Baill. in Madagascar and South Africa, and *A. Gregorii* F. Muell. in North Australia.

Adansonia digitata Linn., indigenous in tropical Africa, is grown in many places in India. It is pretty common about Madras, but is chiefly met with in Bombay, being plentiful on the coast.

The fruit is composed largely of a dry acid pulp which, in Bombay, is mixed with butter-milk and used as an astringent in diarrhoea and dysentery. In the Konkan, the pulp with figs is given in asthma; with the addition of cumin and sugar it is made into a sherbet, and administered in bilious dyspepsia.

According to the Bombay Gazetteer, the wood possesses antiseptic properties, and the bark is antiperiodic and a useful substitute for quinine in low fever.

The bark was at one time exported to Europe and used as a febrifuge in lieu of cinchona bark. It is still highly commended as an antiperiodic in the West Indies and in some parts of South Africa. In Cameroons it is sometimes used medicinally like the leaves.

In Gold Coast the bark is used instead of quinine for curing fever. The cream of tartar surrounding the seeds is made into a cooling drink in cases of fever. The pulp of the fruit is considered a specific in putrid pestilential fevers.

The native medicinal use of the pulp as a remedy or palliative and diaphoretic for fever and dysentery is widespread in tropical Africa, and the article was for a time exported to Europe from the East Sudan for this purpose. In Senegal, dysentery is treated by giving rice-water in which rust has been boiled and the baobab pulp added. Smallpox is similarly treated, and also a thick emulsion of the pulp is put in the eyes of the patient several times a day.

In Gambia the root is used as a febrifuge.

The dried leaves in powder form are credited with medicinal properties, promoting perspiration and preventing kidney and bladder troubles; they have been proved serviceable in diarrhoea, fevers, and other maladies. In Senegal an infusion of the powder is used internally or locally applied for a variety of inflammatory conditions, as a preventive of fever, for dysentery, internally or as a hip-bath, and similarly for genito-urinary conditions; also as a lotion for earache, ophthalmia, etc.

In Nigeria the leaves coarsely pounded are boiled with bran and salt or plant ashes, and administered to horses in bolus form. As a food, given in large quantity, this preparation keeps a horse in good condition without fattening, or maintains strength on a journey; as a medicine, given in small bulk, it is a tonic and blood maker, and is also given for conditions with subcutaneous swellings due to insect bites.

In Sierra Leone the leaves are used as a prophylactic against fever in the rains, to check excessive perspiration, and as an astringent. An infusion of both flowers and leaves is used for

respiratory and digestive disorders and for eye inflammations. Locally the leaves are applied to reduce inflammatory swellings, or boiled to make a hot lotion, or burnt as a fumigation.

In Hausa a cooling drink is prepared by breaking off a piece of the shell, pouring in water, loosening and mixing the pulp by stirring, and then boiling the emulsion; the beverage is taken cold. The pulp burns with an irritating smoke, and has been used as a fumigant to keep biting insects at a distance from domestic animals.

In Senegal the inner fibrous part of the shell is made into a decoction and used as an emmenagogue. The seeds, roasted and pulverised, as well as the latex, are applied for toothache and inflammation of the gums. A decoction of the young plant from which the bark has been removed is used as an eye remedy. The gummy fluid from the bark of the tree and a powder scraped from the outside of the fruit are applied to cleanse foul sores, stimulating and promoting granulation.

In Madagascar, La Reunion, and Mauritius the leaves are given as an emollient in dysentery and inflammatory fevers. The pulp of the fruit is used in haemoptysis, dysentery, and diarrhoea.

Afrikaans: Krimmetatboom—; *Ajmere*: Kalbriskh, Kalpbriskh—; *Akwapim*: Dadee, Odadee—; *Angola*: Imbondeiro, Nbondo—; *Arabic*: El omarah, Gongoleis, Homar, Hujed, Humar, Oufa, Tabaldi—; *Awuna*: Alagba—; *Bafo*: Njobwih—; *Bakossi*: Njobwele—; *Bakundu*: Ngubwele—; *Balondo*: Ngubwele—; *Balong*: Njobwih—; *Bambara*: Molodo, Sira, Tedum—; *Basari*: Niturr—; *Batanga*: Ngubwele—; *Bemoba*: Toreg—; *Benin*: Ushi, Usi—; *Bombay*: Choyarichinch, Gorakhaamli, Gorakhchincha, Gorokhchintz—; *Brong*: Ala—; *Canarese*: Brahmamlika, Magimavu—; *Chiswina*: Muwugu—; *Dagomba*: Tua—; *Dagarti*: Tuo—; *Deccan*: Hathikhattyan—; *Delhi*: Kalbriskh, Kalpbriskh—; *Dutch*: Apenbroodbloom—; *English*: African Calabosh, Baobab, Cork Tree, Cream of Tartar Tree, Ethiopian Sour Gourd, Maputa, Sour Gourd—; *Ewe*: Adido, Alagba—; *Falor*: Ba—; *Fanti*: Efuo-bodedwo, Efuo-brodidwa—; *French*: Arbre de mille ans, Baobab, Baobab d' Afrique, Boabab, Calebassier du Sénégal, Grosmapou, Pain de singe—; *Fufulde*: Bokki—; *Fulani*: Boha, Boki, Bokki—; *Ga*: Shadzo—; *Gbari*: Kwahi—; *German*: Adansonie, Boabab—; *Gold Coast*: Cream of Tartar Tree—; *Guam*: Toto—; *Gujerat*: Bukha, Gorakhaamli, Moramlreli, Rukhdo—; *Hausa*: Kuka—; *Hindi*: Gorakamali, Gorakhamli, Goramlichora—; *Italian*: Baobab—; *Kabure*: Taelu, Telu—; *Kamba*: Mwamba—; *Kanuri*: Kuka—; *Khartoum*: Gongalasu—; *Konkomba*: Nitule—; *Kontagora*: Kuka—; *Koranko*: Sire, Sirele—; *Kratchi*: Kellai, Kelle—; *Krepi*: Dindo, Dodo—; *Krobo*: Saletcho, Salo—; *Lagos*: Ushe—; *Limba*: Kutidi—; *Lokko*: Hokbawai, Sakwi mbawi—; *Losso*: Telo—; *Makalanga*: Mguya—; *Malinke*: Boki—; *Mandingo*: Sito—; *Marathi*: Gorakhchinch—; *Masai*: Ol imisora—; *Matabele*: Umkomo—; *Mauritius*: Baobab, Gros mapou, Anai pouliya, Bumni umli—; *Mbonge*: Ngubwele—; *Mende*: Bo-wulni—; *Morar*: Vilaytiyimbi—; *Mossi*: Toyega—; *None*: Boh—; *Nupe*: Muchi—; *Porebunder*: Gorakhambali—; *Portuguese Africa*: Embondeiro—; *Portuguese Guinea*: Calabaceira—; *Russian*: Adansonia, Baobab—; *Sakalave*: Sefo—; *Sanskrit*: Chitrala, Choramli, Dirghadandi, Gandabahula, Gopali, Gorakshi, Panchaparnika, Sarpadandi, Sudandika—; *Serere*: Bak—; *Shuwa Arabic*: Hamar, Hamaraya—; *South Africa*: Baobab, Cream-of-Tartar Tree, Lemonade Tree, Monkey Bread Tree—; *Spanish*: Baobab—; *Susu*: Kiri—; *Swahili*: Mbuyu—; *Tamil*: Anaippuli, Papparappuli, Perukku, Puri—; *Telugu*: Barhmamlika, Maggimavu, Simachinta—; *Tigre*: Hoemmer, Hoemret—; *Tigrinia*: Dima, Dumma—; *Timne*: Diaroebai—; *Tschaudjo*: Taelu, Telu—; *Tukulor*: Boki—; *Twi*: Adade, Ototaa, Ototowa—; *Walo*: Alu—; *Wolof*: Gui—; *Yoruba*: Ose, Oshe—.

Bombax.

This genus includes 60 tropical species.

B. Ceiba Linn. is used medicinally in China, Cambodia, Malaya, and the Philippine Islands; *B. brevicuspe* Sprague in Liberia; *B. buonopozense* P. Beauv. in tropical West Africa.

Bombax Ceiba Linn. (=*B. malabaricum* DC.) occurs throughout the hotter parts of India, Burma, and Ceylon. It is abundant on the eastern side of India, ascending to 4,000 feet in altitude. It is distributed to Malaya, Sumatra and Java.

The root has stimulant and tonic properties. The bark and the root are emetic. The young roots, dried in the shade and powdered, form the chief ingredient in the *muslasemul,* a medicine highly thought of as an aphrodisiac; it is also given in impotence. The roots of saplings upto about three years old are known as 'Semarkanda' in the Central Provinces and are used as a nerve tonic and as an astringent.

The gum or dried juice, *mocha-ras,* which the tree yields, is used as an aphrodisiac. It contains a large proportion of tannic and gallic acids, and may be successfully employed in cases requiring astringents. The gum has also tonic and alternative properties, and is used in diarrhoea, dysentery, and menorrhagia.

The dried flowers, with poppy seeds, goats' milk, and sugar, are boiled and inspissated, and of this conserve two drachms are given three times a day in haemorrhoids.

The flowers and fruit in combination with other drugs are recommended for the treatment of snake-bite and scorpion sting; but Caius and Mhaskar have shown experimentally that neither the flower nor the fruit have any antidotal value against snake or scorpion venoms.

In Cambodia the bark is used as a styptic in abnormal uterine bleeding, the root is considered diuretic, and the gum is occasionally administered in water for gonorrhoea.

In China the flowers are applied externally to boils, sores, and itch.

Basim: Khatsawar—; *Bengal*: Roktosimul, Simul—; *Bhil*: Khatseori—; *Bombay*: Katesaveri, Saer, Saur, Semul, Shembal, Somr—; *Burma*: Didu, La-i, Lepanbin, Letpan—; *Cambodia*: Roka—; *Canarese*: Apurani, Buraga, Burga, Burla, Dudi, Elava, Hatti, Kempuburaga, Kempuburga, Mullelava, Mulluburaga, Pishphele, Sauri—; *Central Provinces*: Semar, Semur—; *Ceylon*: Parutti—; *Chinese*: Mu Mien—; *Deccan*: Kantonkakhatyan, Kantonkasemul, Lalkhatyan—; *English*: Cotton Tree, Red Cotton Tree, Red Silk-cotton Tree, Silk-cotton Tree—; *Formosa*: Moc-main, Pun chi—; *French*: Bombax de Malabar, Cotonnier Mapou, Kapokier du Tonkin—; *Garhwal*: Shimal—; *Garo*: Bolchu, Panchu—; *Gond*: Vallaiki—; *Gujerat*: Ratoshemalo, Sauvor, Sawar, Shemalo, Shimar, Shimlo, Shimul—; *Hazara*: Simbal—; *Hindi*: Kantisembal, Pagun, Ragatsemal, Ragatsembrel, Raktasimul, Semal, Semul, Semur, Shimbal, Simal, Somr—; *Indo-China*: Gao, Sich moc mien thu—; *Khond*: Kamba—; *Kolami*: Del, Edel, Idel—; *Konkani*: Sanvor, Sauvor—; *Kumaon*: Shimbo—; *Lambadi*: Chamblero—; *Lepcha*: Sunglu, Tung-glu—; *Magahi*: Lapaing—; *Malaya*: Mook min, Simur—; *Malayalam*: Ilavu, Mocha, Mullilava, Pichila, Pula, Purani, Unnamuriku—; *Mal Pahari*: Simue—; *Marathi*: Kantasair, Kanterisamar, Kantesavar, Khatsawar, Sair, Sairi, Samar, Savara, Savari, Sayar, Semal, Shevari, Simlo, Tamari—; *Matheran*: Sarvar, Tambdi savar—; *Melghat*: Saori—; *Mund'ari*: Edelsanga—; *Palkonda*: Wuraga—; *Persian*:

Simbal—; *Portuguese*: Algodoeiro do matto, Arvore de panha, Panheira sumauma—; *Punjab*: Sum—; *Sanskrit*: Apurani, Bahuvirya, Chirayu, Chirjivi, Dirghadruma, Dirghapadapa, Dirghayu, Duraroha, Kadala, Kalpavriksha, Kantakadruma, Kantakaria, Kantakashtha, Kukkutavandaka, Kukkutti, Mahavriksha, Mocha, Mochani, Nirgandhapushpi, Nissara, Pnachaparni, Pichhala, Purani, Raktapushpa, Raktotpala, Ramyapushpa, Salmili, Shalmali, Shalmalini, Shimulu, Sthirayu, Sthulaphala, Tulavriksha, Tulini, Tuliphala, Yamadruma—; *Santal*: Edel—; *Saora*: Buroh—; *Sinhalese*: Kattuimbul—; *Sutlej*: Shirlan—; *Tagalog*: Bobuygubat, Buboygubat, Malabulac—; *Tamil*: Agigi, Ilavam, Ilavu, Kongu, Mullilavu, Parutti, Pongar, Pulai, Purami, Sallagi, Samani, Sanmali, Selavagu, Sitten, Surabu—; *Telugu*: Buraga, Kondaburaga, Mundlaburaga, Pinnaburaga, Salmali—; *Tulu*: Ala, Mullala—; *Uriya*: Buro, Mochoroso, Salmali, Simuli—; *Visayan*: Quesero, Salay, Talutu—.

CEIBA.

This genus consists of 10 tropical species, mostly American.

Ceiba pentandra (Linn.) Gaertn. (=*Eriodendron anfractuosum* DC.) occurs in the forests throughout the hotter parts of India and Ceylon; it is distributed to South America, the West Indies, and tropical Africa.

The juice obtained from the roots is considered a most valuable cure for diabetes.

The tree yields a gum which is astringent and used as a remedy for bowel complaints. It is a popular remedy for diarrhoea and dysentery.

The unripe fruit is regarded as demulcent and astringent.

In Cambodia the bark is used as a diuretic, astringent, and febrifuge; the very young plant with its leaves and bark is used externally in fevers as a lotion or a bath, and is given internally as an emetic to cure drunkenness; the fruit is prescribed in migraine and vertigo.

In Annam the bark is considered emetic; the flowers are given in lochiorrhoea, and in plague; the oil from the seeds is used as an emollient.

In Ubangi-Shari a decoction of the root is used internally as a drink and externally as a lotion in cases of emaciation and general debility.

In Guinea the young leaves are used as an emollient, and a decoction or infusion of the flowers is given as a laxative.

In La Reunion the bark is used as an emetic.

The leaves and fruits have emollient properties and are used in various parts of tropical West Africa to wash the head and face in fever, headache, etc. A decoction of the flowers is used in French Guinea for constipation. In parts of Cameroons the bark is pounded and macerated in cold water to apply to a swollen finger. In Liberia an infusion of the bark is used as a mouth-wash.

Abé: Gbi—; *Abuan*: Umum—; *Agni*: Enya—; *Akposso*: Ju, Juna—; *Anago*: Ogufé—; *Anang*: Ukum—; *Angola*: Mafuma, Mafumeira, Suma-uma—; *Annam*: Cay gao, Cay gon, Cay moc khoang, Moc mien—; *Aowin*: Enya—; *Aro-Chuku*: Agpu-ugu—; *Ashanti*: Ongina, Onyang, Onyina—; *Atakpame*: Huti, Wuti—; *Attié*: Muong, Nguéhié—; *Awuna*: Fuleng, Futi, Vu, Vuti—; *Bakwiri*: Buma, Wuma—; *Balundu*: Bum—; *Bambara*: Bana, Banan—; *Banda*: Kopou—; *Bariba*: Gouma—; *Baulé*: Nyé—: *Basari*: Bubumbu, Bufu—;

Bemoba: Gbang—; *Bengal*: Shwetsimul—; *Benin*: Okha—; *Bicol*: Cayo—; *Bobo-Dioulasso*: Pi—; *Boki*: Bokum—; *Bondoukou*: Ton'go, Ton'ko—; *Brignan*: Etchoui—; *Brong*: Ekile—; *Burma*: Thinbawle—; *Bussanke*: Gbée—; *Cambodia*: Kor—; *Canarese*: Apurani, Bilibarlu, Biliburaga, Biliburga, Buraga, Burga, Dudi, Elava—; *Cebu*: Bulacdondol—; *Central America*: Ceiba—; *Ceylon*: Elavam, Illaku, Imbul, Pulunimbul—; *Cuba*: Ceiba—; *Dagarti*: Goni—; *Dagomba*: Gunga—; *Dahomey*: Dehon, Gué dehonsu, Hunti—; *Dakpwa*: Kapou—; *Deccan*: Khatyan, Sufedkhatyan—; *Dendi*: Bantan—; *Diola*: Busaira, Busana—; *Ebrié*: Agué—; *Efik*: Ukem, Ukum—; *Engenni*: Akawu—; *English*: Cotton Tree, Kapok, Kapok Floss, White Cotton Tree, White Silk-cotton Tree—; *Ewe*: Ewu, Futi, Vu, Vuti, Wu, Wudesé—; *Fanti*: Nyahene, Nyina—; *Fong*: Huti, Wuti—; *French*: Bois épineux, Fromager commun, Kapokier, Ouatier—; *Fulani*: Bantahi, Bantignei, Bentegnievi, Linihi, Rinihi—; *Ga*: Onyai-tsho—; *Gbari*: Gehi, Gyehi—; *Gbaya*: Guela, Guila—; *Gouin*: Belon—; *Gouro*: Ngoué—; *Grand Popo*: Hunti—; *Guam*: Algodon de Manila—; *Guene*: Bentan habu—; *Gujerat*: Doloshamlo—; *Gurunshi*: Gung—; *Hausa*: Rimi, Rini—; *Hindi*: Hattian, Katan,, Safedsemal—; *Hova*: Landihazobe—; *Ibibio*: Ukem akabi, Uman ukem—; *Ibo*: Akbo, Akbu, Akpu—; *Ijaw*: Asisaga, Kpasukaro, Shakka, Shakra, Sishara—; *Ilocano*: Capas, Capassanglay, Dondol—; *Indo-China*: Gon, Kok niou, Kor—; *Java*: Kapok—; *Jekri*: Egungun—; *Jolo*: Capoc—; *Kabure*: Komu—; *Kalabari*: Afalafasi—; *Kanuri*: Tom—; *Khandesh*: Katsavan—; *Konkomba*: Bufu-sogbum, Kpugbum—; *Konno*: Banda—; *Kontagora*: Rimi—; *Kpandu*: Loe—; *Kratchi*: Keshafu—; *Krepi*: Ofwho, Ovua, Wuti—; *Krobo*: Leno—; *Kukuruku*: Okho—; *Kwale*: Akpo—; *Lagos*: Eggun—; *Lahu*: Egna—; *Langwasi*: Kepou—; *Laos*: Kokuiyu—; *La Reunion*: Ouatier—; *Losso*: Bahun, Ubonbe—; *Lower Amazon*: Sumaumeira—; *Malayalam*: Ilavu, Mullillapappula, Nakuli, Panni, Panniyala, Pula—; *Malinke*: Bana, Banan, Busana—; *Mamprussi*: Gunga—; *Mandingo*: Bantang, Bantango, Bentafore, Bentang, Bentango, Bintaforo—; *Mano*: Geh—; *Marathi*: Pandhari, Pandhrasaur, Salmali, Safetasavara, Samoli, Shamieula—; *Mende*: Nguwe—; *Nago*: Ogufe—; *Nankani*: Gonga—; *None*: Len—; *Nzima*: Eguina, Eniémé, Enyan'goua—; *Nupe*: Kuchi—; *Onele*: Tiou—; *Onitsha*: Akpu-ogwu, Ok-akpu—; *Onitsha Olona*: Kpakpa—; *Owerri*: Akpu-udele, Mbom—; *Pampangan*: Bulac castila—; *Portuguese Guinea*: Pelon, Poilao—; *Sakalave*: Moraingy, Pamba, Pemba—; *Salaga*: Kakre—; *Sango*: Ndoulou—; *Sanskrit*: Chiragu, Kutashalmali, Kutsitashalmali, Mocha, Rochana, Salmali, Shvetasalmali, Sthiraya—; *Sarracole*: Batiugne—; *Sassandra*: Go—; *Savalou*: Gué dehunsu—; *Sefwi*: Enya—; *Serere*: Bouday, Mboudaye—; *Shuwa Arabic*: Rum—; *Sinhalese*: Imbul, Kottapulung, Pulung—; *Sobo*: Okahen—; *Spanish*: Algodon de Manila—; *Susu*: Konole—; *Tagalog*: Boboy ,Bubuy, Bulac, Bulac sino—; *Tagouana*: Sérigné—; *Tamil*: Ilavam, Karukkanam, Panji—; *Telugu*: Kadami, Tellaburaga—; *Timne*: Am-polong, A-pullo, Ke-polong, Ma-pullo—; *Tivi*: Vambe, Yambe—; *Tschaudjo*: Komu—; *Tulu*: Ala—; *Turca*: Blo—; *Twi*: Ongina, Onyang, Onyina—; *Umu Ahia*: Akpo—; *Urdu*: Sambal—; *Visayan*: Daldol—; *Wassaw*: Enyina—; *Wele*: Tiou—; *West Indies*: Silk-cotton Tree—; *Wolof*: Bantang, Bantango, Bentang, Bentango, Bentegnié, Benten, Betenbi—; *Yoruba*: Araba—.

IV

The TERNSTROEMIACEAE are trees or shrubs of tropical Asia and America. A few are to be found in Africa.

Stimulant, astringent, and antidysenteric properties. Some barks are powerful vesicants.

The stimulants owe their action to the alkaloids caffeine and theophylline. Methyl salicylate and quercitrin have been isolated from some of them.

Medicinal properties are to be found in 9 genera: ACTINIDIA (Eastern Asia); ANNESLEA (Indo-Malayan); CAMELLIA (India, China, Japan); GORDONIA (Indo-Malaya, China, North America); KIELMEYERA (South Brazil); NESOGORDONIA (Madagascar); SAURAUJA

(tropical Asia, America); SCHIMA (Eastern Indo-Malaya); TERNSTROEMIA (South America, Asia).

The medicinal species of India belong to 6 genera: ANNESLEA, CAMELLIA, GORDONIA, SAURAUJA, SCHIMA, TERNSTROEMIA.

A. Peduncles many-flowered ... ... SAURAUJA.

B. Peduncles one-flowered.

1. Fruit half inferior, drupaceous ... ... ANNESLEA.
2. Fruit superior.
   a. Anthers basifixed ... ... TERNSTROEMIA.
   b. Anthers versatile.
      i. Seeds wingless ... ... CAMELLIA.
      ii. Seeds winged.
         α Radicle inferior. Fruit globose ... SCHIMA.
         β Radicle superior. Fruit oblong ... GORDONIA.

ANNESLEA.

The genus consists of 2 species inhabiting Burma, Camodia, and the Malay Peninsula.

Anneslea fragrans Wall. occurs in the Eastern Peninsula, Moulmein and Martaban.

The bark and the flowers are used medicinally in Cambodia. The former is considered antidysenteric and anthelmintic; the latter are said to be antiperiodic.

Cambodia: Sauphi—.

CAMELLIA.

The genus consists of about 10 species spreading from India to Japan.

Root and bark astringent and antidysenteric; leaves astringent, antidysenteric, digestive, tonic, and diaphoretic.

C. japonica Linn. is used medicinally in China, *C. Thea* Link in China and Indo China.

Flowers erect, sepals deciduous ... ... *C. drupifera.*
Flowers nodding, sepals persistent ... ... *C. Thea.*

1. **Camellia drupifera** Lour. occurs in Eastern Himalaya, at 3,000-7,000 feet, from Nepal to Bhutan; in Assam and the Khasia Mountains, at 5,000-8,000 feet; in Tenasserim and the Andaman Islands.

The oil-cake from the seeds is used in Tongking to stupefy fish.

Indo-China: Cha mai, Dan-che, so—.

2. **Camellia Thea** Link (= *Thea sinensis* Linn.) occurs in Assam and the hilly country to the East of it, and in Upper Burma. It has been cultivated for ages in China and Japan. It is now extensively cultivated in Assam, Cachar, Sikkim, North-Western Himalaya, the Nilgiris, and Ceylon.

Tea is astringent and gently excitant, and exerts a decided influence over the nervous system.

Arabic: Chha—; *Assam*: Hilkat—; *Burma*: Letpet—; *Cachar*: Dullicham—; *Canarese*: Cha, Chaha, Theyale—; *Chinese*: Ming—; *Danish*: The—; *Dutch*:

Thee—; *English*: Assam Tea, China Tea, Indian Tea, Tea—; *French*: Thé, Thé de Chine, Théier—; *German*: Thee—; *Gujerati*: Chah—; *Hindi*: Cha, Chha—; *Hungarian*: Tea—; *Indo-China*: Cao lo, Cha, Cha ginh, Che, Te ve, Tra, Tra hue—; *Italian*: Te—; *Japanese*: Teh, Tsja—; *Malaya*: Cha, Te—; *Malayalam*: Chaya, Teyila—; *Marathi*: Chaha—; *Mundari*: Cadaru—; *Muttack*: Khlap, Misaphlap, Phlap—; *Persian*: Ca, Chha, Chaikathai—; *Polish*: Te—; *Portuguese*: Cha, Cha da India—; *Punjabi*: Cha—; *Roumanian*: Ceaiu—; *Russian*: Tshay—; *Sanskrit*: Chaha, Chavika—; *Scotch*: Te—; *Sinhalese*: Thaygas—; *Spanish*: Te, Te de China—; *Swedish*: Thee—; *Tamil*; Karupputteyilai, Pachaitteyilai, Teyilai—; *Telugu*: Nallateyaku, Teyaku, Tiyaku—; *Tulu*: Cha—; *Turkish*: Chai—; *Urdu*: Chai—; *Uriya*: Cha—.

GORDONIA.

The genus numbers 20 species, found in the Indo-Malayan region, China, and North America.

Gordonia obtusa Wall. occurs in the Konkan, the Western Ghats of the Madras Presidency chiefly of the Eastern side, usually from 5,000 to 7,000 feet, lower in Travancore.

In the Nilgiris an infusion of the leaves is given as a stomachic, stimulant, and appetiser.

Badaga: Nagatte—; *Kadir*: Attangi, Ola—; *Nilgiris*: Nagetta—; *Tamil*: Miyilai—.

SAURAUJA.

The genus numbers 60 species distributed over tropical Asia and America.

Saurauja napaulensis DC. occurs in Temperate Himalaya, from Bhutan and Sikkim—at 5,000-7,000 feet—to Garhwal—at 2,400-5,000 feet; in the Khasia Mountains, at 5,000 feet; in the Mishmi Hills.

In Tongking the bark is used as a poultice to help the extraction of splinter imbedded in the flesh.

Hindi: Gogina—; *Jaunsar*: Ratendu—; *Kumaon*: Gogin, Gogna, Gugna—.

SCHIMA.

The genus consists of 10 Indo-Malayan species.

The bark is vesicant.

S. Noronhae Reinw. is used medicinally in Indo-China.

Flowers in a loose terminal corymb, peduncles smooth slender	*S. crenata.*
Flowers in a short terminal raceme, peduncles with minute white warts	*S. Wallichii.*

1. **Schima crenata** Korth. occurs in the Eastern Peninsula from Tenasserim to Penang, and in Burma. It is distributed to Borneo and Sumatra.

The stem and the sap are used medicinally in Cambodia. The stem is given in nausea; its bark is vesicant. The extremities of the young shoots are gently warmed and the sap that exudes is dropped in the ear for otitis.

Cambodia: Trathok—; *Indo-China*: Rma, Sang soc, sat hat—.

2. **Schima Wallichii** Choisy occurs in Nepal, Sikkim up to 5,000 feet, Bhutan, Assam, the Khasia Hills, Manipur, Chittagong, and Upper Burma.

The bark is nearly black externally, with deep clefts; the liber is made up of an abundance of white, needle-shaped cells, which are readily detached and act as cowage, in producing painful irritation, when brought into contact with the skin.

Anthelmintic and rubefacient.

Assam: Chilauni, Makria, Makusal, Mukriasal—; *Bhutia*: Samching—; *Burma*: Ananpho, Laukya, Theetya—; *Cachar*: Jam—; Duars: Chilauni—; *Garo*: Boldak—; *Goalpara*: Gugera—; *Hindi*: Chilauni, Makriya, Makriyachilauni, Makusal—; *Khasia*: Dingan—; *Lepcha*: Sambrong—; Sung-brong kung, Sung-sung kung—; *Nepal*: Chilauni, Goechassi—; *Sema*: Michi-sii—; *Sikkim*: Chilauni—.

TERNSTROEMIA.

The genus numbers 35 species inhabiting tropical Asia and America.

Ternstroemia japonica Thunb. occurs in Eastern Bengal and the Eastern Peninsula, from the Khasia Mountains at 4,000-5,000 feet to Moulmein; in the Western Peninsula, in the Nilgiris; and in Ceylon. It is distributed to Sumatra, China, Japan, and the Loochoo Islands.

The bark and the root are astringent. They are used in Japan as an antidysenteric.

Indo-China: Giang nui, Hoa bi huong, Son cha hoa—.

V

The HYPERICACEAE are herbs, shrubs or trees, spread over the temperate and hot regions of the globe, and especially in the northern hemisphere. There are 8 genera with about 210 species.

The medicinal Tutsans of the world belong to 5 genera: CRATOXYLON (Indo-Malayan); HARONGA (tropical Africa, Madagascar, Mauritius); HYPERICUM (cosmopolitan, temperate regions); PSOROSPERMUM (tropical Africa, Madagascar); VISMIA (tropical America).

Two of the above, CRATOXYLON and HYPERICUM, are represented in India.

1. Capsule dehiscing loculicidally. Seeds winged ... CRATOXYLON.
2. Capsule dehiscing septicidally or at the placentas. Seeds not winged ... ... HYPERICUM.

CRATOXYLON.

The genus consists of 12 species inhabiting tropical Asia.

C. Hornschuchii Blume is used medicinally in Java, *C. neriifolium* Kurtz in Indo-China.

Cratoxylon neriifolium Kurtz is found in Chittagong, and in Burma: Teiyet, Pegu, Prome hills.

In Tongking, an infusion of the leaves is considered a very powerful digestant.

Indo-China: Nganh nganh, Thank nganh—.

Hypericum.

The genus numbers 220 species, spread over the whole world, chiefly in temperate regions.

Vulnerary, astringent, and anthelmintic. The seeds may be diuretic and antispasmodic.

The following are used medicinally:—in Europe—*H. Androsaemum* Linn., *H. barbatum* Jacq., *H. Coris* Linn., *H. elegans* Steph., *H. hircinum* Linn., *H. hirsutum* Linn., *H. humifusum* Linn., *H. montanum* Linn., *H. perfoliatum* Linn., *H. perforatum* Linn., *H. pulchrum* Linn., *H. quadrangulum* Linn., *H. Richeri* Vill., *H. tetrapterum* Fries.—; in Indo-China—*H. ascyron* Linn., *H. chinense* Linn., *H. erectum* Thunb., *H. japonicum* Thunb. *H. patulum* Thunb., *H. Sampsoni* Hance—; in Malaya—*H. japonicum* Thun.—; in Southern Africa—*H. aethiopicum* Linn., *H. lalandii* Chois.—; in La Reunion—*H. angustifolium* Lam.—; in Madagascar— *H. japonicum* Thunb.—; in North America—*H. Ascyron* Linn., *H. maculatum* Walt., *H. mutilum* Linn., *H. perforatum* Linn.—; in Colombia—*H. Brathys* Lam., *H. Chamaemyrtus* Tr. and Pl., *H. Humboldtianum* Steuder, *H. mexicanum* Linn., *H. platyphyllum* Gleason, *H. thesiifolium* H. B. K.—; in Brazil—*H. connatum* Lam., *H. laxiusculum* St. Hil.—.

A. Sepals 5, unequal; petals deciduous; stamens 5-adelphous at the base; ovary 5-celled.
   1. A glabrous shrub, 30-90 cm. high ... ... *H. patulum.*
   2. Stem none but branches innumerable ... ... *H. chinense.*

B. Sepals 5, connate at the base, equal or unequal; petals persistent; stamens 3-adelphous at the base; ovary 3-celled.
   1. Styles twice the length of the ovary, equalling the stamens ... ... *H. perforatum.*
   2. Styles very short ... ... *H. Sampsoni.*
   3. Styles half the length of the ovary ... *H. humifusum.*

C. Sepals 5; petals persistent; stamens connate at the base; ovary 1-celled ... ... *H. japonicum.*

1. **Hypericum chinense** Linn., a native of China, is cultivated in many Indian gardens.

The plant is astringent and alternative. In Indo-China the leaves and the green stems are made into a paste and applied to bites from dogs and stings from bees.

Indo-China: Kim ty dao—.

2. **Hypericum humifusum** Linn. grows in the Nilgiris. It is distributed over Europe, the Atlantic Isles, and South Africa.

In Europe the flowers are infused in olive oil or in alcohol and used as a vulnerary, chiefly for old sores and eczema.

English: Trailing St. John's Wort—.

3. **Hypericum japonicum** Thunb. is found in temperate and subtropical Himalaya, the Khasia Hills, Assam, Burma, Eastern and Western Peninsula, and Ceylon. From Japan it spreads to China and Indo-China, the Philippine Islands, Java, Australia, New Zealand, and Madagascar.

In China and Indo-China the plant is credited with astringent and alterative action, and externally it is used as vulnerary.

In Madagascar the plant is used as a vulnerary, styptic, antiasthmatic, and antidysenteric.

Betsimisaraka: Manitsorohina—; *Cantonese*: Thin Kee Wang—; *Chinese*: T'ien Chi Wang—; *Hova*: Anangoaika, Anantatara, Tsikotrakotra, Voantrotroka—; *Imerina*: Tsikotrokotroka—; *Indo-China*: Ban—.

4. **Hypericum patulum** Thum. occurs in the Khasia Hills 5,000-6,000 feet; throughout the temperate Himalaya (except Sikkim) at 3,000-7,000 feet, from Bhutan to the Ravi. It is also found in China, Formosa, and Japan.

The scented seeds are employed as an aromatic stimulant in Patna, where they are imported from Nepal (Irvine).

In Indo-China they are used both externally and internally as a remedy for the bite of dogs and the sting of bees.

Behari: Tumbhul—; *Indo-China*: Kim ty mai—.

5. **Hypericum perforatum** Linn. occurs in the temperate Western Himalaya at 6,000-9,000 feet; in Kashmir and Simla, apparently not in Kumaon. It is distributed to Northern temperate Asia, Europe, and North Africa.

The plant has been, and is still, recognized in Europe as aromatic bitter, astringent, resolvent, expectorant, and nervine. It is used in all pulmonary complaints, bladder troubles, in suppression of urine, dysentery, worms, diarrhoea, hysteria and nervous depression, hoemoptysis and other haemorrhages, and jaundice. For children troubled with incontinence of urine at night an infusion or tea given before retiring will be found effectual; it is also useful in pulmonary consumption, chronic catarrh of the lungs, bowels, or urinary passages. Externally for fomentations to dispel hard tumours, caked breasts, ecchymosis, etc.

It is recommended in Arabian medicine as a vermifuge; and is also used to cure piles, prolapsus uteri and ani.

The red juice is esteemed in Europe and China as one of the most popular and most curative applications for excoriations, wounds, and bruises.

The juice gives a red colour to the spirit of wine with which it is mixed, and to expressed oils. The oil of St. John's Wort is made from the flowers infused in olive oil. This oil is highly useful for healing bed sores, and is commended as excellent for ulcers.

The flowering tops are bitter, terebinthinate, acrid, and vulnerary. A salve compounded from the flowers, and known as St. John's Wort Salve, is still much used and valued in English villages.

Homoeopathic practitioners prepare a medicinal tincture with spirit of wine from the entire fresh plant, collected when flowering, or in seed, and this proves of capital service for remedying injuries to the spinal cord, both by being given internally and used externally. It has been employed in like manner with benefit for lockjaw.

Yunani practitioners consider the leaves a good application for

scorpion sting. However, Caius and Mhaskar have shown experimentally that the leaves are not an antidote to scorpion venom.

The weed is poisonous to horses.

Arabic: Lioufarikoun, Khashkhash-el-asoued, Mesmoune—; *Catalan*: Herba de cop, Herba foradada, Herba de Sant Joán, Hypericon, Pericó groc—; *Chinese*: Ia Iou—; *Danish*: Jordhumbe, St. Hans urt—; *Dutch*: St. Jans Kruid—; *English*: Amber, Devil's Scourge, Grace of God, Hard Hay, Hundred Holes, Lord God's Wonder Plant, St John's Grass, St John's Wort, Terrestrial Sun, Witch's Herb—; *Finland*: Werdu heino—; *French*: Chasse diable, Herbe à millepertuis, Herbe à mille trous, Herbe aux piqûres, Herbe de la Saint-Jean, Herbe saint Jean, Millepertuis, Millepertuis officinal, Trascalon perforé, Trescalan, Trucheron jaune, Truscalan—; *German*: Christiankraut, Christignadenkraut, Christikreuzblume, Christikreuzblut, Christiwundkraut, Christwundkraut, Conradskraut, Durchwachs, Elfenbeutkraut, Frauvonwurde, Gartheu, Harthau, Hartenan, Hartheu, Hasenkraut, Hexenkraut, Jagemichel, Jageteufelkraut, Johannesblume, Johanniskraut, Hohannesblut, Hohanneskraut, Hohannsinkrut, Kannsblut, Sankt Johanniskraut, Scharnokel, Schernekel, Tausendloch, Teufelsflucht, Teufelsraub, Unsereliebenfrauenbettstroh, Urldgartheil, Wolfkraut—; *Hindi*: Bassant, Dendhu—; *Italian*: Cacciadiavoli, Erba di San Giovanni, Iperico, Ipericone, Perforata, Pilatro—; *Languedoc*: Trescalan, Trescoulaou—; *Malta*: Pitted St. John's Wort, Cacciadiavoli, Erba di San Giovanni, Iperico—; *North America*: Balm-of-warrior's-wound, Cammock, Common St John's Wort, Penny-John, Rosin-rose, Tipton-weed—; *Polish*: Dziurawice—; *Portuguese*: Herva de San Joao, Hypericao, Milfurada—; *Provence*: Herbo de l'oli rouge, Herbo de la San-Jean—; *Punjab*: Bassant, Dendlu—; *Roumanian*: Iarba lui Sfant Ioan, Iarba sfantului Ioan, Pojarnita, Sunatoare—; *Russian*: Zweroboi—; *Spanish*: Corazoncillo, Hierba de las heridas, Hypericon, Pericon, Yerba de San Juan—; *Swedish*: Johannisoert—; *Urdu*: Balsana—.

6. **Hypericum Sampsoni** Hance occurs in the Khasia Mountains. It is distributed to South China and Formosa.

In Tongking the plant is used as a vulnerary.

Indo-China: Nguyen bao thao—.

VI

The Elatinaceae are herbs or undershrubs, widely dispersed, especially in the Old World. They inhabit ditches and the submerged shores of ponds and rivers. There are 30 species grouped in 2 genera.

The plants credited with medicinal properties all belong to the genus Bergia.

Bergia.

The genus consists of 25 species, inhabiting tropical and temperate regions.

B. decumbens Planch. is used medicinally in South Africa, *B. guineensis* Hutch. and J. M. Dalz. in Northern Nigeria.

Bergia odorata Edg. is found in Sind, Western Rajputana, and Gujerat. It is distributed over Persia, Egypt, and tropical Africa.

Used for cleaning teeth and, in Jodhpur, applied to broken bones. The leaves rubbed down in water are used as a poultice for sores (Macadam).

Hadeija: Babargiwa—; *Porebunder*: Gangharun, Lavadiyun, Okharal—; *Rajputana*: Karbuja, Kakria, Rohwan—; *Sokoto*: Bushi, Dushiya, Jisshiya—.

OBITUARY

CLAUD BUCHANAN TICEHURST.

Dr. C. B. Ticehurst died at Hastings on the 17th February 1941. His death has removed from our midst a man whose name will rank with those great ornithologists who in their time have contributed so much to our knowledge of the avifauna of India and the adjoining countries.

Born at St. Leonards-on-Sea, on the 8th January, 1881, Claud Ticehurst was the third son of Dr. Augustus R. Ticehurst. He was educated at Tonbridge School, and at St. John's College, Cambridge, where he distinguished himself in 'Natural Science'. Ticehurst elected to follow his father's profession and, after taking his medical degrees at Guy's Hospital, London, settled down to practice. Except for a brief interval during the first World War, when he was commissioned as a Captain in the R.A.M.C. and served between the years 1917 and 1918 as surgical specialist at the British Military Hospital, Karachi, the whole of his professional career centered in private practice at Lowestoff, Suffolk and finally at Appledore in Kent.

When quite a boy Claud Ticehurst revealed his love for the subject which became the absorbing interest of his life, and of which he was destined to become so able an exponent. His leisure was given to exploring the bird life of his native downs and marshes, while annual holidays in Norway, in company with his father, widened his knowledge of his hobby. Later a scientific training and education developed this early interest and gave Ticehurst that thorough understanding of varied ornithological problems, that precision and meticulous regard for fact which became the hall mark of all his work.

As an ornithologist, Ticehurst's main interests centered in systematics and in problems relative to the migration and geographical distribution of birds. He was also interested in questions relating to plumage and its development—a study which had been scarcely touched when he made his initial contribution to it.

He achieved international repute. Besides his many and varied contributions to British Ornithology, his studies extended to many parts of Europe, to North and South Africa and to India and the adjoining countries.

In paying this tribute to his memory we wish to associate it particularly with his ornithological work in the East. Ticehurst's work here was mainly directed to the avifauna of the great Palaearctic Desert which extends from the shores of North Africa through Arabia, Mesopotamia and Persia to the province of Sind. His interest in the bird life of this great and little known region commenced during his service at Karachi, where he devoted his spare time to the study of local bird life. He started to write a paper on the birds of the district, but extended it to what became finally the most up to date and authoritative account of the birds of

the Province. His study of the birds of Sind naturally implied a consideration of the birds of the neighbouring province of Baluchistan. There was little on record to help him. Fortunately the Society was able at the time to place at his disposal a large collection of birds made by Mr. Hotson, I.C.S. (afterwards Sir Ernest Hotson) during his political travels in Kalat and Mekran. Ticehurst also made brief visits to the Province. He spent the months of September-October 1919 at Ziarat and also visited Quetta and the Las Belas Frontier district. His paper on the Birds of Baluchistan published in our *Journal* provides the most complete account now available of the avifauna of that Province. A further opportunity to extend his studies of the birds of the Palaearctic Desert was provided by the collections brought together by members of the Society in Mesopotamia during the Great War. These collections formed the basis of the first comprehensive account of the Birds of Mesopotamia, published originally in our *Journal*, which Ticehurst wrote in collaboration with Capt. P. A. Buxton and Major R. E. Cheesman. Under war conditions collecting in Mesopotamia was naturally limited, and after the war it was decided to extend the survey of bird life to areas hitherto untouched or very partially worked. Thanks to the interest of Sir Percy Cox, who engaged the services of the Society's Collector, Mr. V. LaPersonne and to the efforts of Major R. E. Cheesman, between the years 1920 and 1923, supplementary collections were obtained which enabled Ticehurst to publish in our *Journal* a second paper on the avifauna of Iraq, written this time in collaboration with Sir Percy and Major R. E. Cheesman.

Collecting was also extended to the Islands of the Persian Gulf some of which were visited by Sir Percy and Major Cheesman personally and others by LaPersonne. Notes made by these three observers and their collections provided the material for Ticehurst's paper on the Birds of these islands, which was published in our *Journal*.

Sir Percy, was also instrumental in obtaining for Dr. Ticehurst an invitation from the Sultan of Najd to collect birds and mammals in his territory. This gave Ticehurst a unique opportunity of studying the bird life of the Arabian Peninsula and the great South Desert. In company with Major Cheesman, he spent four months of the cold weather of 1923 travelling in this desolate region, which had never been previously entered by Europeans. His paper on the birds of Jabrin, Jafura, and Hasa in Central and Eastern Arabia contains the results of this expedition.

It will be seen that the advance which has been made in recent years in our knowledge of the avifauna of the Asiatic countries lying within the Palaearctic Desert is due largely to the work of Ticehurst. In appreciating the thoroughness and ability with which he would carry it out, the Society and its members gladly gave him such assistance as they were able. Subsequent to his return to England, Ticehurst interested himself in the birds of Burma. He died before completing his work, which would have undoubtedly resulted in the authoritative account of the avifauna of that province which one expected from his researches. He

wrote two papers on Burmese birds for our *Journal*. The first was based on a collection made by Mr. Villar, I.C.S., in South Arrakan. The second was written in association with Mr. J. K. Stanford and dealt with birds of the Prome district in which few ornithologists had worked previously.

Apart from these contributions to faunistic ornithology, Ticehurst's interest in systematics led him into the unravelling of many problems relative to the nomenclature and status of Indian birds. While finality may not be attained always in these matters, his conclusions always carried the assurance of the most critical enquiry into all available data, and the most painstaking study of ascertained facts. He published descriptions of many new species and races of Indian birds, numerous notes on synonymy and nomenclature and critical reviews of genera and species, outstanding among the last was his review of the genus *Phylloscopus,* recently published by the Trustees of the British Museum. Indian Ornithology benefited also from Ticehurst's various studies on the plumage of birds. While in India, he collected notes on the down plumages of Indian birds and with the help of the material he obtained by his own efforts and with the assistance of some members of the Society, he published in our *Journal* a preliminary paper on the subject. He continued to collect data with a view to making further contributions to this wholly neglected phase of Indian Ornithology. During his many years of ornithological work, Ticehurst brought together a fine collection of birds, which was considerably extended during his travels abroad. While in Sind he collected over 1,500 specimens from the province. His collection will now find a permanent resting place in the British Museum. During his brief stay in Bombay, he spent much of his time in the Society's rooms working on our bird collections. This was not the least of the many services for which we must remain grateful to Claud Ticehurst, who in his time did so much for the progress and advancement of Ornithology in India.

S. H. P.

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REVIEWS

I.—'PRELIMINARY GUIDE TO INDIAN FISH, FISHERIES, METHODS OF FISHING AND CURING'. Agricultural Marketing in India. Marketing Series No. 24, pp. 154, pls. 57, 1941. Manager of Publications, Delhi. Price: Re. 1 or 1*s.* 6*d.*

Though the potential wealth of Indian fisheries is immense, it is greatly to be regretted that the exploitation of both maritime and riverine fisheries occupies only a very minor place in the economic life of the country. The Royal Commission on Agriculture directed attention to this unfortunate state of affairs, but little has been done so far towards the development of the fisheries. It is, however, a matter of satisfaction that a marketing survey of the fisheries of the country has been included in the programme of work of the Agricultural Marketing Adviser to the Government of India. During the very early stages of such a survey it became evident that the multitude of vernacular names of the fishes current in different parts of the country is a great hindrance in the way of any marketing investigations and accordingly a 'Preliminary guide to Indian fish, fisheries, methods of fishing and curing' was planned so that the marketing investigators and others engaged in the trade should have a common nomenclature of the forms concerned.

Fishes.—It is explained in the 'Foreword' that 'The aim has not been to make the guide a scientific compilation and hence, all the detailed characteristics which define a particular fish are not given in the description.' This, however, is no excuse for some gross scientific inaccuracies which have crept into an otherwise admirable and useful publication. For instance on plate 1, the length of body (AE) is given as the distance between the tip of the snout and the base of the caudal fin, while on plate 2, 'Body' is incorrectly shown as the region between the posterior border of the operculum and the base of the caudal fin, this mistake is unfortunate as on the page opposite the plate a correct definition of the length of the body is given. Again on plate 2, the caudal fin is incorrectly marked as 'Tail'. The tail region of a fish is the portion of the body behind the vent or the anal opening.

Another serious mistake is the inclusion of the Pearlspot, *Etroplus suratensis* (Bloch), in 'The Carps Group'. The Carps, comprising the famous Rohu, Catla, Mrigal, Mahseer, and a host of other similar forms, belong to the order Ostarophysi, whereas *Etroplus* belongs to Percomorphi and as such should have been included among 'The Mackerels and the Perches Group'. The series of spines in its dorsal and anal fins readily indicate its position among the fish popularly known as the 'Perches'.

In the section dealing with 'The "Live fishes" or air-breathing fishes of India Group', the author has included only the Murrals and the Climbing Perch. The stalls of the numerous fish-markets in Calcutta on the other hand show that Magur (*Clarias batrachus*) and Singhi (*Heteropneustes fossilis*) form a large proportion of 'Jiol Machh' or 'Live Fishes'. An account of Magur is given in another place (p. 20), but Singhi is not referred to in the 'Guide'. In this connection, a reference may be made to the reviewer's article 'Trade in Live *Fish* (*Jiol Machh*) in Calcutta' (*Journ. As. Soc. Bengal,* N. S. vol. xxx, pp. 1-15, pls. i-vi, 1934).

The omission of any reference to the valuable *Hilsa* (known as Pulla or Palo in Sind) fishery in Sind (p. 29) may also be noted, besides many other minor faults of omission and commission to which attention could be directed. Though for the scientific names of the various species of fish listed in the 'Guide', Day's nomenclature has rightly been followed, it would have been advantageous to give in the account of each species its up-to-date scientific name. Some of the scientific names are either incorrect, such as *Panulirus fasciatus* should be *Panulirus polyphagus* (p. 69), *Ostrea circullata*

should be *Ostrea cucullata* (p. 73), etc., or wrongly spelt, such as *Muraenesox talabonoides* (pp. iii, 13), *Trichiurus haumela* (pp. iv, 39), *Equula splendens* (pp. iv, 42, 43).

Crustaceans.—The section dealing with Crustacea is, on the whole, a fairly accurate summary of Dr. B. N. Chopra's article listed in the Bibliography. A few mistakes have, however, crept in which should be rectified in a later edition. For instance, on page 68 it is stated: 'In prawns which are found in the sea or in brackish water, the first three walking legs end in claws . . .' Dividing the commercial prawns into 'marine' and 'fresh-water' and then mentioning this distinction between the two would suggest that this character holds good for the four species described as 'marine'. In *Leander,* however, the first three walking legs do not end in claws. This character really distinguishes the Palaemons from the Penaeids, and *Leander* for all scientific purposes is very closely allied to *Palaemon.* The distinction between 'marine' and 'freshwater' species is unsatisfactory. On page 70, it is stated 'In crabs the last leg is in the form of a paddle.' In the swimming crabs the last leg is in the form of a paddle, but in most other crabs it is not so. In the freshwater crab, *Paratelphusa,* for instance, the last leg is not paddle-like. On page 71, in the account of the 'Chilka Lake fishery', it is mentioned that 'enclosures are constructed with circular or oval openings'. As a matter of fact the traps themselves are arranged in the form of a circle (or an oval), and a small gap is left on one side close to the bamboo fence.

Molluscan Shell-fish.—The place assigned to the shell-fishes in the 'Guide' seems to give the impression that the shell-fishes are not of much value as food or as articles of trade and commerce in comparison with fish *sensu stricto.* It is claimed in the 'Foreword' that it is not merely intended as a guide to the departmental men but also 'to fishermen—both amateur and professional—as well as to traders, students and others.' It is not a little surprising therefore to find in this compilation very meagre information on the shell-fisheries of India among which are included only clams and oysters constituting minor shell-fisheries.

The pearl-oyster and chank fisheries of the Palk Bay and the Ramnad Coast in S. India which have been carried on for many years find no place in this publication. Nor is any mention made of the window-pane oysters, the sea, backwater and the freshwater mussels so common along the coasts of India, or of the top- and turban-shells which have been fished along the Andaman and Nicobar coasts for over a decade and exported to Singapore and other Far East markets. These shell-fishes which must be included among the major shell-fisheries are commercially of very great importance.

General.—The descriptive part should prove useful for the identification of various species, but here again considerable improvement could be effected by a careful revision. However, the large number of excellent figures of various species taken from different sources will be of particular help in this connection.

The sections of the work dealing with the 'Preservation and curing of fish', 'Industrial products', 'The Fishing areas of India and the fishing gear used in them', and 'Special note on the fishing methods for Crustaceans' are rather sketchy and could have been improved very greatly as a mass of unsorted material already exists in a number of official publications of the different provinces and in other journals; this would have proved instructive and helpful to industrialists, traders and others interested in the development of fisheries. Perhaps, in a preliminary guide a more detailed knowledge of these subjects was considered beyond the scope of such a publication.

In the 'Foreword', an acknowledgment is made to the Zoological Survey of India for their co-operation in compilation. It is, however, necessary to make it clear that this co-operation consisted in making literature and specimens available to the officer deputed by the Agricultural Marketing Adviser to the Government of India and in general guiding him in the execution of the work through suggestions, discussions and criticisms. The manuscript of the 'Guide' was unfortunately not sent to the Survey before publication as its revision by the specialists in the Department would not only have been useful for eliminating errors but also for suggesting various improvements in the arrangement and treatment of the subject matter.

S. L. H.

II.—'HANDBOOK OF ECONOMIC ENTOMOLOGY FOR SOUTH INDIA'. By T. V. Ramakrishna Ayyar, B.A., Ph.D. 8vo., i-xviii+528 pp. Government Press, Madras, 1940. Price Rs. 4-12-0.

Good books on economic entomology in India are few and far between. Only two come to our mind—Lefroy's well known work, *Indian Insect Life* (1909) which is a classic, and Fletcher's excellent volume, *Some South Indian Insects* (1914). It, therefore, gives us special pleasure to review the excellent *Handbook* before us from the pen of India's veteran entomologist, Dr. Ramakrishna Ayyar, who was, until recently, Entomologist to the Madras Government. The book which is the ripe product of an experience of a life-time of research and teaching, is at once up-to-date and authoritative Hundreds of excellent illustrations add greatly to the utility of the volume. It is our considered view that the *Handbook* will be found indispensable not only to the South Indian entomologists for whom it is primarily meant, but also to entomologists, whether teachers or research workers, all over India and in the neighbouring countries, whose entomological problems are similar to those of tropical India.

The book is divided into two parts. Part I, which covers the first eighty-five pages, is divided into six chapters and deals with the fundamentals of general entomology. Among the subjects dealt with are: the position of insects in the animal world; the external and internal morphology of insects; reproduction, metamorphosis, growth and multiplication; general features of insect activity in relation to food, temperature, humidity and other factors in the environment; and finally, insect classification.

Part II deals with economic entomology. The first three chapters cover the fundamental principles underlying insect control, and the methods employed for that purpose, such as dusting, spraying, biological control, etc. Various mechanical appliances necessary for the purpose are also explained. This is followed by a detailed account of the pests of the important crops and fruit-trees in South India, such as paddy, millet, pulses, and palm-trees. A chapter is devoted to the pests of stored products and to the insects affecting domestic and farm animals. Another chapter deals with the household and disease-carrying insects. Finally in the last chapter are discussed beneficial insects such as the honey-bee, the silk-worm, and so on.

The most important and extensive part of the book from the point of view of agricultural economic entomology is naturally devoted to chapters dealing with the crop pests. Under each crop, its important insect pests are considered. Under each pest, an account is given first of its economic importance, structural peculiarities and distribution. This is followed by an account, usually with illustrations of its life-history and habits. Finally, the measures required for its control are discussed.

The book ends with five useful appendices. The first gives a list of the South Indian crop pests, with their chief host-plants, arranged according to the insect orders. The second contains synoptic keys for the systematic recognition of various insect orders and suborders. The third deals with the technique for the collection and study of insects, and also gives some useful chemical formulae for the killing, preservation and control of insects. The fourth deals briefly with the crop-pests other than insects, such as eel-worms, snails and slugs, mites, rats and birds. The fifth consists of a list of references on the insects of economic importance in South India, a list which, incidentally, contains some 154 titles. This is followed by an index.

Having said so much in praise of the book, a few remarks may be made about its minor blemishes. Let it be stressed that these remarks are made not with a view to detract from the general excellence of the book. On page 12 it is stated that the insect head is composed of six segments. There is now clear evidence for seven segments. On page 17, table, it is stated that the compound eyes of insects are homologous to the segmental appendages. This view was abandoned long ago, and there is no proof in its favour. On page 34, under the different kinds of reproduction in insects, the author omits to refer to the important and striking phenomenon of paedogenesis in which insect larvae or pupae undergo parthenogenetic reproduction without first attaining the adult stage.

The chapter on classification, pp. 70-85, is in our opinion, the least satisfactory portion of the book. The author prefers, for practical reasons, to stick to the ancient 9-order classification of insects, in contrast to the modern 23-order classification which he finds unpractical. This has resulted in strange combinations which today seem odd and unfamiliar. Thus, Anoplura are placed under Hemiptera, and Mallophaga under Neuroptera! Under Apterygota, only two orders, Thysanura and Collembola, are included; the Protura being excluded altogether. On page 71 the author gives Hemiptera and Homoptera as separate orders; and Anoplura and Mallophaga are separated, with Isoptera in between. These groupings are untenable. We would strongly urge the adoption of the 23-order classification, as for example that given by Imms in his Text-book. On page 73, the long-horned grasshoppers are referred to the family Locustidae. This name was suppressed long ago by Tettigonidae.

We would like to congratulate both the author and the Madras Government in producing a first-class book which will remain in the field for many years to come. The printing and get-up are extremely good. We can heartily recommend the book to all entomologists.

B. P. & M.L.R.

III.—'INSECT PESTS OF BURMA'. By C. C. Gosh, 1940.

This is a recent work by Mr. C. C. Gosh, till lately Entomologist in Burma, and published under the auspices of the Government of Burma. The outstanding feature of the book is that it is very well illustrated with a number of full page plates the great majority of which are in colour; in addition there are numerous black and white text-figures. In view of the fact that the author has confined himself only to the treatment of insects affecting field crops, stores and households in Burma, it is rather unfortunate that the title of the book should have so comprehensive and therefore liable to be misunderstood. To justify its rather ambitious title, information on other insect pests of Burma—such as pests of useful trees, cattle and other domestic animals, etc., should also have been included in the work. Lastly in view of the fact that rats and crabs have been unceremoniously included under insect pests, a more appropriate title of the book would have been 'Some crop pests of Burma'.

The subject matter of the book which runs to 215 pages is divided into two parts; the first, of forty-two pages, is intended to deal with 'general facts in connection with the insect life and pests', and the second with the 'pests'. To elucidate the facts in connection with the first part the author has selected sixteen insects (perhaps as types?); this list which is headed by the degenerate, nontypical *Head louse,* includes the bed bug, aphis, thrips, silver fish, etc. One fails to find out what were the criteria in selecting these heterogeneous and mostly nontypical forms to explain the general features of insects; a good many of them are only sucking forms and at least two or three are degenerate, absolutely nontypical examples of insects, quite unsuited for the purpose. Even in dealing with these insects no attention has been paid to explain the comparative morphological features of such important structures as body divisions, mouth parts, limbs, etc., or any of the outstanding physiological features like locomotion, breathing, reproductive phenomena, etc. In speaking of the metamorphosis, the author does not explain what the differences are between complete and partial metamorphosis; and in this connection he unfortunately characterises *Lepisma* as an insect with *incomplete metamorphosis,* though it is too well known that *Lepisma* and all other members of the group Aptera are typical examples of insects *without metamorphosis* (Ametabola). Nor is the insect group to which each of these types belongs indicated. In this first part are also added notes on 'Beneficial animals and insects', a rough classification of Insects and 'Prevention and control of damage by insects', which includes insecticides, spraying apparatus, etc.

Though the major portion of Part II deals chiefly with insect pests of different crops, the author has at the beginning selected nine which he calls general pests, and deals with their features and control. If the idea was to give examples of different categories of pests and their treatment, the selection is

extremely unfortunate. Six out of the nine are sucking forms, and the remaining two are not insects at all! (rats among insect pests)! It is a pity the author did not find it more convenient to select some of the commonest types of pests like grass-hoppers, caterpillars, beetles, etc. for the purpose. The remaining portion of the matter in the book deals with insect pests of different crops like rice, cane, etc. grown in Burma. The great bulk of this matter is made up chiefly of the explanations of the various plates and text-figures. It may be interesting to add in this connection that Mr. K. D. Shroff, who was Entomologist in Burma before the author, as early as 1919, published a list of the insect pests of Burmese crops (*vide* Rpt. of 3rd Ent. Meeting Pusa); and though the author has not referred to this list, a comparison of the insects in that list with those noted in this book might be interesting. In dealing with the pests of important crops like Rice, Sorghum, Cane, etc. it is very unfortunate that attempts have not been made to get many of these insects properly identified; some are without names, others with wrong names, and others have old or defunct names—for example: we have Paddy thrips p. 54, the Sorghum chafer p. 68, Sorghum stem fly p. 69, the Wheat aphis p. 74, termite p. 76, Cotton mealy bug p. 117, Blister beetle p. 119, beetle p. 160, etc. It is also strange that even information as to the group or family to which the different pests belong has not been given in most cases. Taking for instance a pest like the saw fly (Athalia) p. 127, how is the reader to know that the insect is neither a caterpillar nor a fly! The remark that the Cane mealy bug is the same as the one on paddy (p. 87) is unfortunate; the one on Cane is *Trionymus sacchari* and that on Rice is *Ripersia oryzae* G. On Cane a woolly aphis (*Oregma lanigera*) is mentioned; this appears to be an interesting record of a pest not commonly recorded from India, but unfortunately the author has neither given a figure of it nor sufficient information *re* its local distribution, incidence, etc. In dealing with pests of pulses some of those previously noted by Shroff have been left out in the book as for e.g. *Adisura* and *Clavigralla*. It is a pity the author still retains the good old name *Pectinophora* (p. 114) for the pink boll worm (*Platyedra*). The author does not refer to the grass-hopper *Aularches* in connection with sesamum though Shroff says it was once bad on that crop. The author's explanation for the term death's head moth (p. 121) is indeed very amusing! The old name (*Euphalerus*) is still retained in the book for the Citrus phyllid (*Diaphorina*) p. 173. Similarly the old names *Dasychira* and *Pachyzancla* are also retained. The title 'White wax mealy bug' (p. 180) for *Ceroplastes cereferus* is not only unfortunate, but inexcusable, since the insect is not a mealy bug at all! Under 'Other minor pests' of the Coconut palm (p. 191) is included the butterfly *Udaspes folus*; this is not a coconut insect, but a specific pest of turmeric, ginger, etc.; this name under coconut palm appears to be a mistake for *Gangar thyrsis*, a butterfly which has been noted before by Shroff on coconut in Burma. It is really unpleasant to have to remark that in dealing with the various insect pests, greater attention has been paid to already known forms—both in India and Burma—especially to those in the colour plates, while those that appear to be specific to Burma and about which we know very little have not received the treatment they deserved—as for example: the woolly aphis p. 88, Cane weevil p. 82, Bean stem borer beetle p. 107, the Citrus bark borer p. 171, Mulberry leaf roller p. 179, Mulberry trips, p. 178, Mulberry stem beetles p. 181, Grape vine Chrysomelid p. 183, Fruit flies on peach, etc. p. 185; the elephant beetle p. 189, etc. The pests of fruit trees have not at all been sufficiently treated (pp. 175, 182, 183 and 185). A fairly good number of insects listed by Shroff have also been left out in the book, as for example insects like *Naranga, Oxya, Menida, Tettigoniella* on Rice, *Thrips* on maize, *Adisura, Clavigralla* on pulses, *Aularches* on sesamum, *Gallobelicus* and *Phyllotreta* on tobacco, etc., etc. The absence of even a passing reference to the unique record of a fruit fly in Plantains (*Chaetodacus diversus*) in Burma by Shroff (see p. 40 Second Notes on hundred Indian Insects 1919) is indeed a great pity, since that is the only record of fruit fly attack on Plantains so far from India and Burma. The sandwiching of Rats (p. 49) and Crabs (p. 57) among insects without a word of explanation is to say the least of it odd.

A few remarks may be made regarding the illustrations on which the author has laid a good deal of emphasis in his introductory remarks. There are in all 87 full page plates and 106 black and white text-figures; of the former over

75 are colour plates. The numbering of these plates lacks uniformity—some are numbered Pl. xlvii (47) while others Pl. 46, etc. The names of insects in Pl. 38 and 72 are quite different from the ones given in the text on the opposite pages 100 and 147. Reference to Pl. 72 under mango fruit flies on p. 166 appears wrong as *D. cucurbitae* is not a mango fruit fly. Though all these plates and many text-figures have already appeared before in Government of India publications, the insects in a good many of them do not show the correct names—e.g. Pl. i, v, x, xi, xlvii, lxii, lxvii, etc. There is no reference to Pl. I on p. 127 when speaking of mustard aphis! Fig. 104 p. 211 is *T. abruptella W.* and not *tapetzella L* (see Fletcher 'Hundred notes p. 34). Coming to the text figures a good many are without names or with wrong or imperfect names; for e.g. Figs. 3, 10, 11, 14, 16, 19, 21, 27, 32, 34, 35, 50, 92, etc., etc. It is a pity that the author could not put down the names of even many of the well known forms such as the *housefly*, the *honey bee*, the *flea*, *potter wasp*! As far as one could make out there are some plates both coloured and black and white which do not appear to be prepared at Pusa and which the author has not acknowledged for example Plates 12, 45, 83. Some of the illustrations do not show the exact specific names of the insects e.g. Colour Pl. of *Earias*, mango fruit weevils p. 165, *Idiocerus* p. 164, etc.

The author has baptized some well known insects with some new popular names such as 'Yellow shoot borer' for the white borer, 'Coconut leaf nibbling caterpillar' for *Nephantis*, 'Rice grain nibbling caterpillar' for *Cirphis*, 'Rice leaf binding caterpillar' for *Chloridea assulta*, 'grain binding caterpillars' for meal worms, etc. Such new names unfortunately only add to our confusion *re* popular names.

As regards remedial measures suggested there are some which are truly extraordinary: for mealy bugs on stored potatoes—Dip in strong rosin compound; for sorghum midge—resistent varieties should be grown; rosin compound for thrips; keep watch on fields for hispa, strip the plants of all side leaves for pink mealy bug on Cane; for the leaf roller the leaves are better unrolled and the caterpillars destroyed! etc. Here and there in the text there are some astonishing statements worth noticing—as for example the life history of *Disphinctus* (a capsid) is similar to the green bug (*Nazara*)—, eggs are laid on the trees—, Scales and mealy bug (*lac*) on custard apple—, the offsprings too never know or look after the parents—, one and a half weeks—, young male bug turns into pupa—; mites are tiny spiders—, caterpillars live from shoot to shoot or plant to plant—the caterpillar occurs which is hatched from egg laid by a butterfly and in its turn develops into a butterfly—, prevents the birth of fresh beetles in the field p. 64!

As for spelling and other errors, many of which are perhaps printer's devils, there are a fairly good number, and it is unfortunate an errata slip was not prepared and attached to remedy at least some of these. Some glaring examples are Nov*ia*, Bollw*a*rm, D*is*dercus, C*a*ntar*e*nia, Pempher*is*, S*h*aenobius, *G*ossary, etc. The arrangement and size of the matter, proper types for headings and pages, etc. could have been paid a little more attention. The first line on p. 43 begins 'In this chapter' (in the absence of division into chapters in this book one wonders) what the *Chapter* referred to here is! The big heading on p. 182 is *Mole Rat* and under it appear Tamarind, Papaya, Cashew, etc. in small type headings.

On the whole, however, there is no doubt that as a handy reference collection of colour plates of many Indo-Burmese Insect Pests (which had appeared previously in many different works), the book will always maintain its substantial worth. A list of the illustrations and plates in the book at the beginning or end of the work could have enhanced its value for reference purposes.

IV.—'BIRDS OF BURMA' by B. E. Smythies, Burma Forest Service. Edited by H. C. Smith, I.F.S., and P. F. Garthwaite, B.F.S. With a map and 31 coloured plates from paintings by Lieut.-Commander A. M. Hughes, R.N. Pp. xxix—589. American Baptist Mission Press, Rangoon, 1940. Price Rs. 15.

The names of Eugene W. Oates in the seventies and eighties of the last century, of H. H. Harington, J. C. Hopwood and J. M. D. McKenzie in the years slightly preceding and following the last World War (1914-18), and of

J. K. Stanford, H. C. Smith, P. F. Garthwaite and B. E. Smythies (the present author) within recent years, stand out prominently in the domain of Burmese ornithology. The recent systematic work on Burmese birds of the late Dr. C. B. Ticehurst will endure as a monument to the thoroughness and scientific acumen of that widely celebrated ornithologist.

The sum total of the activities of all these naturalists, as well as of others perhaps less heard of but nonetheless earnest students, has been embodied in the excellent volume now before us. Its avowed object is to provide a concise and accurate account of Burmese birds in simple and untechnical language, a purpose which it admirably fulfils, since readability is here reinforced by good coloured illustrations. The 31 coloured plates, illustrating 290 of the commoner birds, specially painted for this book by Lieut.-Commander A. M. Hughes form an attractive feature. It is obvious that Commander Hughes knew his subjects intimately, and his drawings are not only lifelike but in most cases they show the birds in their characteristic attitudes. A welcome item is the scale given at the foot of each plate which enables the reader to get an idea of the relative sizes of the birds. The reproduction of the plates is good on the whole, but in some cases unfortunately it fails to do full justice to the artist. The plain grey background to the illustrations is pleasingly effective.

The Introduction covers a wide range of information calculated to help the beginner and the layman. The modern system of scientific nomenclature is explained and a short section is devoted to Bird Photography. The account of the general topography and meteorology of Burma is interesting and valuable to the student since elevation and rainfall are now recognised as two of the most important factors that control the distribution of birds in any area. From another section entitled 'Protection' we learn that besides the Reserved Forests which cover 34,799 square miles (i.e. 13% of the total area of Burma) there are now 8 Wild Life Sanctuaries, in all about 600 square miles, where all animals (including birds, of course) enjoy complete protection from year's end to year's end. In this matter Burma's example is one that might be emulated with advantage by our Indian provinces where, with a few notable exceptions, practically nothing has as yet been done.

Following the Introduction comes the general body of descriptions of the 1253 species and subspecies that comprise the rich and varied avifauna of Burma. All the available information has been summarised from previous publications under the following heads :

English and scientific name,
Allied forms,
Local names (where existing),
Identification.
Voice,
Habits and Food,
Nests and Eggs,
Status and Distribution.

It is a pity that the authors' names have been omitted after the scientific names. With the initial chaos in scientific nomenclature, especially following the general acceptance of the trinomial system, absence of the author's name rather tends to confound confusion, and this at a time when we are just settling down to the new order. Students will deplore the fact that once again the archaic inch appears as the unit of measurement instead of the now universally employed, and admittedly more rational and scientific millimetre. If it is argued that the book is of a popular nature and written purely for the layman, the reviewer's reply is that in any case the layman, unaccustomed as he is to handling made-up cabinet specimens—some with necks fantastically drawn out, others comically telescoped—can at best derive questionable benefit from a measurement of length thus obtained in relation to the living bird. Also in the case of eggs surely a measurement like 1.37×0.69 inches cannot be less vague to him than the same measurement given in millimetres. The latter would at least have the virtue of conveying something more tangible to the not-so-raw student.

When a further edition of this book is contemplated it is hoped that the author and editors will give due consideration to this point. It is further suggested that the range of wing measurements in millimetres should be given

parenthetically for each bird described. With these minor additions and alterations this work could easily become a first class manual on the birds of Burma even for the rather more advanced student, without in any way lessening its appeal to the layman.

Traditional legends die hard, but it is certainly unfortunate that in spite of the published and verified findings of competent observers, both in this country and in Java, it should have been thought fit to repeat the old time-worn account of the nesting of the Baya Weaver Bird. In the light of recent discoveries it is not at all so difficult to explain the apparent, but not actual, excess of males over females. Moreover, if the texture of a nest be examined in the hand, it will be noticed that the strands do not pass right through the fabric as is implied by the alleged co-operation of the male outside with the female within, in the weaving of the walls. Actually the weaving is done only by the male from without, layer upon layer as it were. The female only occasionally fetches and weaves in a strand inside, but her contribution is in fact no more than what may be called 'interior decoration'.

P. 190. It may be pointed out that the non-breeding plumage of the adult Spotted Munia (both sexes) is also plain brown, as described for the young.

Under 'Habits and Food' the habitats and immediate environments of the birds are well described, and the summaries of Nightjar and Owl calls on pages 306 and 310 will be found of much help in field identification.

The map at the end of the volume shows Burma divided into 10 Distribution Areas. It is to be used in conjunction with the Systematic Handlist which forms the last section of the book. These Distribution Areas and their respective topographical features are more fully defined in the Introduction (pp. xvi-xvii). Their division is based more or less on natural features, definitely a step in the right direction. Civil and political boundaries are often fixed arbitrarily and purely for administrative convenience; they mean nothing when ecology is being studied and have, in the past, led to much confusion.

The text is particularly free from typographical errors. One item on p. 40 has apparently escaped the proof reader. The Lime-Rock Babbler (*Gypsophila crispifrons*) is followed by the Short-tailed Wren-Babbler which also carries the same scientific name. This should of course be *Napothera*.

This is a volume that every bird lover in Burma of course, but also in India, must possess. It is the most concise, handy and up-to-date work on the ornithology of this most interesting transition zone between the two main zoogeographical subdivisions of the Oriental Region.

S. A.

AN APPEAL.

SOCIETY FOR THE PRESERVATION OF THE FAUNA OF THE EMPIRE.

In a recent issue of the *Journal* of the above Society the Editor commented on the fact that he had received a letter describing the Society as the 'Talkie-Talkie' Society; and another letter addressed to the 'Society for the Talk of the Preservation of the Fauna of the Empire'.

One of the correspondents (if not both) is a member of the Bombay Natural History Society. Such ill-considered criticism betokens only ignorance, on the part of the writers, of the work accomplished by the Society with its comparatively small membership, and the very limited funds at its disposal. To take only three instances: the Society's efforts have largely contributed to measures being taken to save the Moufflon of Cyprus; the Thylacine (or Tasmanian Tiger or Wolf); and the Giant Panda from extinction. In many other directions the Society's interest and intervention have helped to ensure the safeguarding of species in grave danger. The Society's work has been recognised and praised by naturalists of all countries interested in the preservation of wild life.

I would ask those critics who seek to belittle the Society's activities to help a good cause by persuading their friends to become members—the subscription is small. By so doing the Society's influence will be the greater, and its means increased.

R. C. MORRIS.

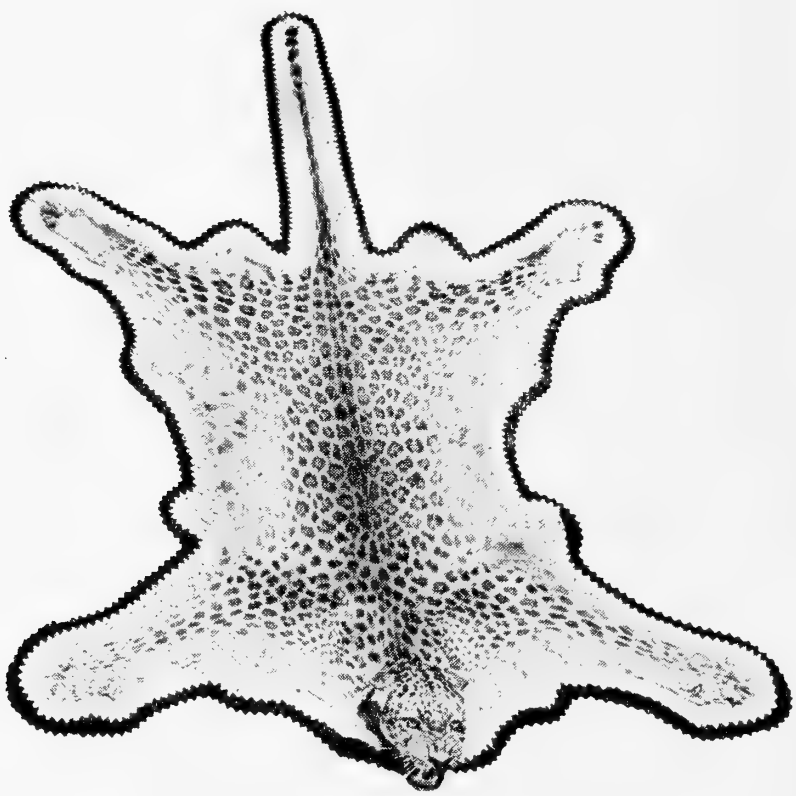
HONNAMETTI ESTATE,
ATTIKAN-MYSORE P.O.,
S. INDIA.
April 19, 1941.

MISCELLANEOUS NOTES

I.—VARIATION IN COLOUR OF TIGERS AND PANTHERS.

(*With two photos*).

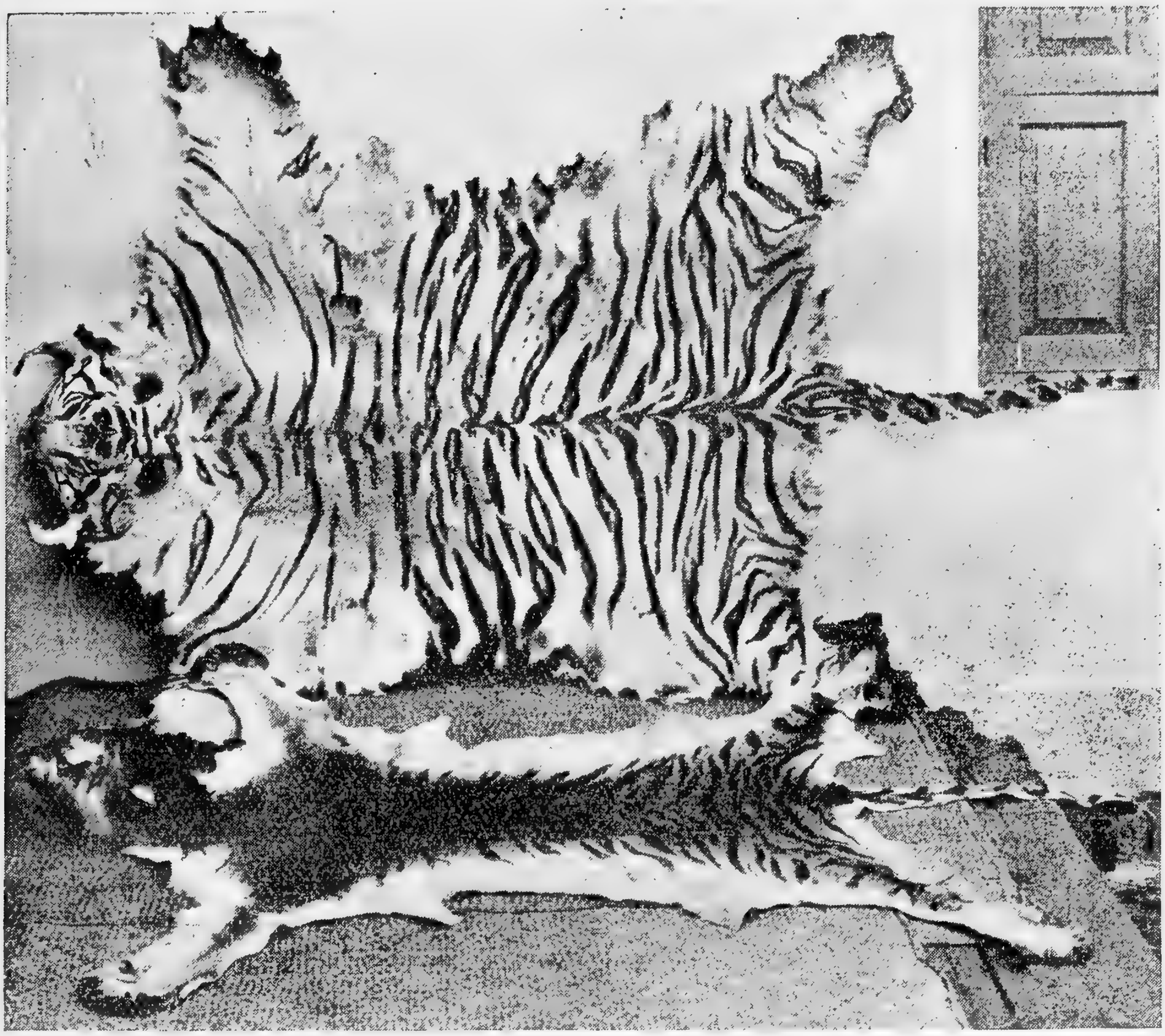
We are sending you two photographs which we think you will find of sufficient interest to publish in the *Journal.* One is a photograph of a Semi-Albino panther and the other is a unique photograph of a red tigress skin together with a white tiger.



Panthers unlike tigers have no tendency to albinoism and except for an instance cited by Mr. Pocock in his account in the *Journal* of panthers, white panthers are unknown. The photograph is of a Semi-Albino panther which was shot last year by the Maharaja Bahadur of Dumraon in Bihar. This panther is white with a pale tan background and rosettes in a darker shade of tan.

The red tigress in the foreground was shot some years ago in Assam by the late Mr. W. G. Forbes. The skin was white with the pale tan background and marked with fine stripes in a

darker shade of tan. Curiously the three last stripes at the tip of the tail were black.



The white tiger shown in comparison was pure white and marked with chocolaté stripes. This tiger was shot by the Ruling Chief of Korea also some years ago.

MYSORE, S.I., VAN INGEN & VAN INGEN,
February 14, 1941.

II.—UNUSUAL BEHAVIOUR OF PANTHERS AND TIGERS.

In your August 1939 issue appeared a note by Col. R. W. Burton under the caption 'Unusual behaviour of Panthers and Tigers'. In this Col. Burton remarks that he has never known of, nor seen recorded, previously the association of a half-grown animal with the very small cub of a later litter and its parents.

In March 1921 Mr. A. S. Vernay and I sat up over a panther kill for two evenings in succession on my Honnametti Estate on the Billigirirangan Hills, S. India. A family of 6 panthers visited the kill—the two parents, two half-grown and two little cubs. The

staid procession of all six, led by the male parent, followed by the two half-grown, then the two small cubs, with the mother bringing up the rear from a shola, across the cart-road, and into the coffee—was a remarkable sight.

In the same note Col. Burton refers to the wanton killing of a number of cattle by a tiger and of 33 sheep by a panther.

In 1940 a tiger killed 5 grazing buffaloes near my Honnametti Estate. In 1935 or 1936 a tiger killed eleven head of cattle of a herd; and seven head of cattle of another herd were killed either by the same or another tiger; near Udhatti at the eastern foot of the Billigirirangans. In both cases the herds were returning to their village pens in the evenings from their jungle grazing grounds.

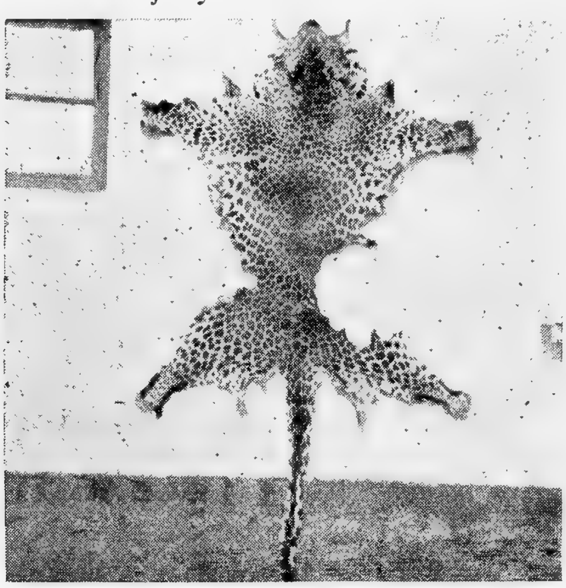
TOBRUCK,
CYRENAICA, LIBYA,
April 12, 1941.

R. C. MORRIS.

III.—AN UNKNOWN VISITOR TO A LEOPARD CARCASE.

(*With a photo*).

Returning to camp late one evening I heard two jackals giving their alarm call; deer, peafowl and jungle fowl took it up, so that it was an easy matter to intercept the cause of their alarm, which turned out to be a large male leopard. He dropped to the shot and then disappeared into some grass. As by that time it was dark and I had no torch I left him. On returning early next morning I found him almost thirty yards from where he was standing when hit and I was very surprised to see that the entire skin over the abdomen had been removed and eaten by some animal, without injury to the inner membrane.



The edges showed teeth marks, but the rest of the skin was not injured in any way, not even where covered with blood from the bullet wound in his chest, and no flesh had been eaten.

The only foot prints I could see round the body were those of a full-grown female leopard and a hyena. The latter had walked up to the dead leopard, but not round it, and I concluded that the leopardess had kept the hyena off during the night and it was only when she heard me approaching that she moved off, and the hyena then walked up, but had no time to take even a single bite.

I have had experience of both leopards and tigers, which have been left for any length of time after being shot, being eaten by

their own kind and by hyenas and jackals, but I have never heard of only the skin being removed and eaten, without injury to the flesh.

Can you or any of your readers throw any light on the matter? I enclose a small photograph of the skin after it had been pegged out and dried.

ROCK HOUSE, C. H. TRESHAM,
SIMLA.
April 2, 1941.

IV.—A FINE SWAMP DEER HEAD.

(*With a photo*).

The enclosed photograph is of a very fine swamp deer head. It was shot by Mr. S. A. Vahid, I.F.S., Divisional Forest Officer, Chanda. The head is an eighteen pointer and measures :—

Right horn 35″ Left horn 36″
12 + 6
Girth (Midbeam) $5\frac{3}{4}$″.

MYSORE, VAN INGEN & VAN INGEN.
February 14, 1941.

V.—ELEPHANTS LYING DOWN.

The question as to whether an African elephant lies down or not has now I think been settled. That it does so, and not infrequently, has been confirmed by Mr. Roy Home and others in recent years.

The Indian elephant lies down more commonly than is supposed. While out in the Palar Valley, North Coimbatore, with Mr. Salim Ali (March 1940) we saw a tusker lying down flat on his side under a large Tamarind tree. The elephant remained in this position for some time, gently curling and uncurling its trunk or covering itself with dust and tamarind mulch from the ground beside it, while another and larger tusker stood on the other side of the tree. This was one of a number of instances to my knowledge.

Honnametti Estate,
Attikan, Mysore, P.O.,
S. India.
June 16, 1941.

R. C. MORRIS,
Captain.

VI.—BIRD NOTES FROM BALTISTAN.

(*With a map*).

The following notes were made during a five-week trip through Baltistan after Ibex, from July 15th to August 20th. The notes apply chiefly to the Deosai Plains and a stretch of about 80 miles of the Indus valley. Here the Indus runs at about 8,000 ft. elevation, flanked by mountains running up to 16,000 ft. or more. The average elevation of the Deosai Plain is about 13,000 ft., surrounded on three sides by higher mountains.

I took with me the 2nd edition of the 'Fauna' and a collector's gun, and only those birds whose identity was definitely established are included.

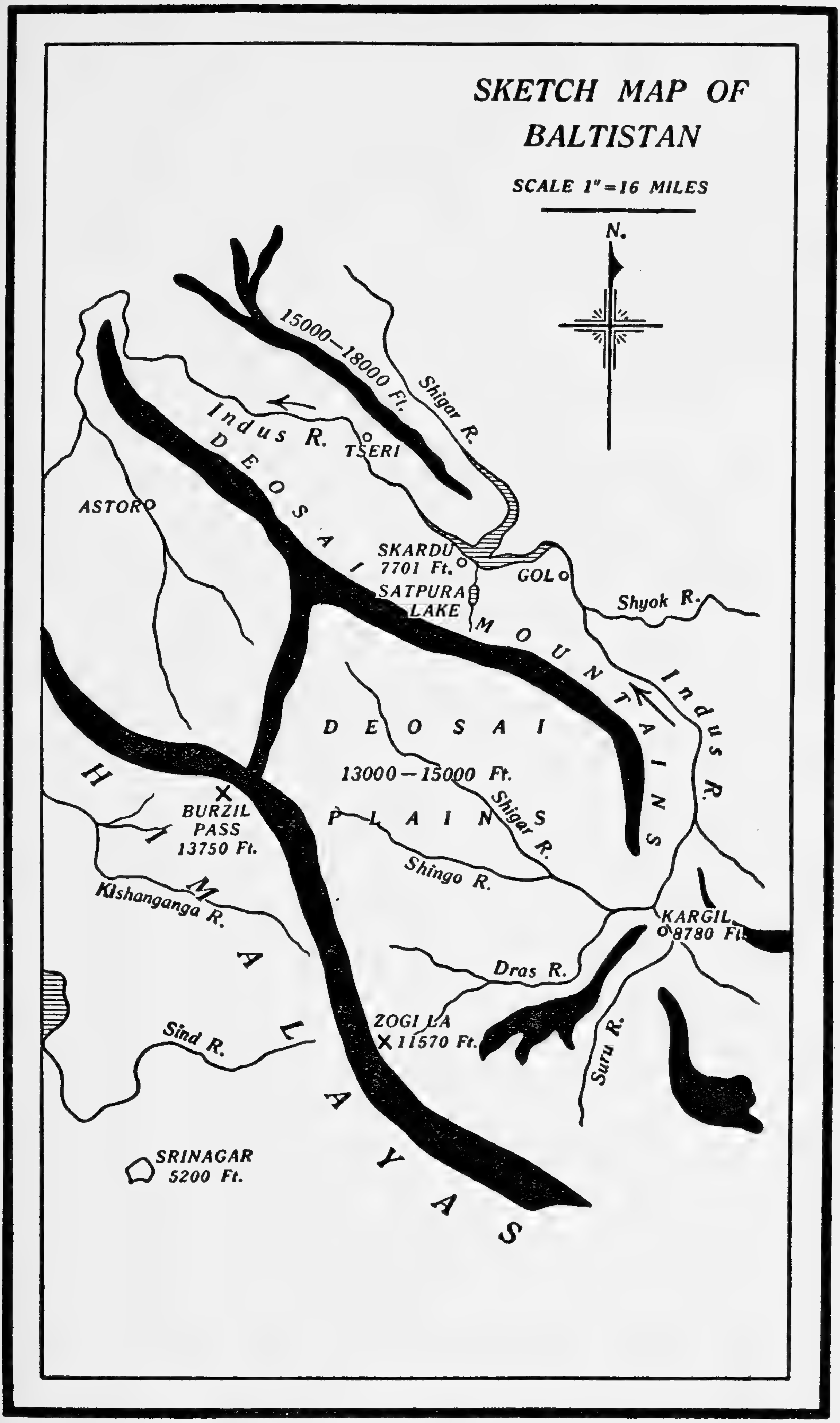
1. **Corvus corax tibetanus** (Hodgs.). Himalayan Raven. Only noted once, when a pair was seen above Gol in the Indus valley at about 14,000 ft.

2. **Corvus coronoidess intermedius** (Adams). Himalayan Jungle-Crow. Occurs sparingly on the Deosai Plain and in the villages of the Indus valley up to 12,000 ft.

3. **Corvus corone orientalis** (Eversm.). Eastern Carrion Crow. Rare. One of a pair was obtained near Gol in the Indus valley at 8,500 ft.

4. **Pica pica bactriana** Borop. Kashmir Magpie. A common and familiar bird in all the Indus villages.

5. **Pyrrhocorax pyrrhocorax** (Linn.). Red-billed Chough.


SKETCH MAP OF
BALTISTAN
SCALE 1" = 16 MILES
N.
15000—18000 Ft.
Shigar R.
Indus R.
TSERI
DEOSAI
ASTOR
SKARDU
7701 Ft.
SATPURA
LAKE
GOL
Shyok R.
MOUNTAINS
Indus R.
DEOSAI
13000 — 15000 Ft.
PLAINS
Shigar R.
Shingo R.
HIMALAYAS
BURZIL
PASS
13750 Ft.
Kishanganga R.
KARGIL
8780 Ft.
Dras R.
ZOGI LA
11570 Ft.
Suru R.
Sind R.
SRINAGAR
5200 Ft.

6. **Pyrrhocorax graculus** (Linn.). Yellow-billed Chough.

Both species are very common throughout the higher hills on both sides of the Indus, up to 16,000 ft. at least, descending to 8,000 ft. in the neighbourhood of villages. Mostly, these two species were found in company, the 'Yellow-billed' predominating round the villages, while at the higher elevations the 'Red-billed' was commoner and found in great numbers. The curious mewing note of the half-fledged young was one of the most persistent noises at my camp in the Tseri nullah at 15,000 ft.

7. **Parus major kaschmiriensis** Hartert. Kashmir Grey-Tit. Occurs sparingly in the Indus valley villages.

8. **Lophophanes rufonuchalis rufonuchalis** (Blyth). Simla Black-Tit. One specimen obtained above Tseri village at 10,000 ft. The only one seen.

9. **Trochalopterum lineatum gilgit** (Hartert). Gilgit Streaked Laughing-Thrush. Occurs fairly commonly in the Indus valley villages up to 9,000 ft.

10. **Tichodroma muraria** (Linn.). Wall Creeper. Seen daily at my highest camp above Tseri at well over 15,000 ft.

11. **Oenanthe picata** (Blyth). Pied Chat. One of the commonest birds of Baltistan occurring throughout the whole length of the Indus valley visited, haunting alike the outskirts of villages and the boulder-strewn barren stretches in between. Family parties with newly-fledged young were seen everywhere. On leaving the Indus this bird is seen less commonly up to the mouth of the Suru river below Kargil and then disappears altogether.

12. **Oenanthe leucomela leucomela** (Pall). Noted and obtained from about 10 miles east of Skardu, where the Indus broadens out, to as far as Tseri Village, increasing in numbers as one progressed westwards.

13. **Phoenicurus frontalis** Vigors. Blue-fronted Redstart. Only one specimen was seen—above Tseri at 14,000 ft.

14. **Phoenicurus ochrurus phoenicuroides** (Moore). Kashmir Redstart. Occurs sparingly on the Deosai Plain, and more commonly on the higher slopes of the Indus valley above 14,000 ft.

15. **Chaimarrhornis leucocephala** (Vigore). White-capped Redstart. Only one bird was seen—above Gol at 9,000 ft.

16. **Cyanosylvia cyanecula abbotti** (Richmond). Eastern White-spotted Blue-throat. Occurs sparingly in the higher cultivated land above 10,000 ft.

17. **Monticola solitaria pandoo** (Sykes). Indian Blue Rock-Thrush. Occurs fairly commonly throughout the Indus valley, both in the most barren country and on the outskirts of villages.

18. **Myophonus temminckii temminckii** (Vigors). Himalayan Whistling Thrush. Occurs in small numbers in the Indus valley, wherever there is cultivation.

19. **Phylloscopus affinis.** Tickell's Willow-Warbler.

20. **Phylloscopus collybitus sindhianus.** Sind Chiff Chaff.

These two species were only once definitely identified when descending from the Deosai Mountains into the Indus valley.

21. **Phylloscopus griseolus** Blyth. Olivaceous Tree-Warbler. A family party was seen above Tseri at 10,000 ft. searching rocks and boulders for food, almost like wall-creepers.

22. **Oriolus oriolus kundoo** (Sykes). Indian Oriole. Occurs commonly in all the Indus villages.

23. **Pyrrhospiza punicea humii** (Sharpe). Western Red-breasted Rosefinch. Seen on several occasions above 14,000 ft. A family party haunted my highest camp above Tseri. They have a very metallic sparrow-like chirp uttered on the wing.

24. **Carpodacus erythrinus roseatus** (Hodgs.). Hodgson's Rosefinch. Occurs commonly in the higher cultivated areas of the Indus valley from Skardu eastwards.

25. **Metaponia pusilla** (Pall). Gold-fronted Finch. A common bird in the larger Indus villages.

26. **Passer domesticus parkini** Whistler. Kashmir House Sparrow. Common at Skardu and neighbouring villages. Much rarer to the East, and not seen at all at Tseri on the West.

27. **Fringilauda nemoricola altaica** (Eversm.). Stolickza's Mountain Finch. Common on the Deosai Plain. Usually seen in small flocks.

28. **Emberiza cia stracheyi** (Moore). Eastern Meadow Bunting. Found in all the Indus villages. Commoner on the west than the east. Not found on the Deosai Plain.

29. **Delichon urbica urbica** (Linn). House-Martin. All specimens shot were of this sub-species. Frequents the more precipitous villages of the Indus.

30. **Ptyonoprogne rupestris** Scop. Crag-Martin. A common bird observed daily throughout the Indus valley at all elevations up to 10,000 ft.

31. **Motacilla alba personata** (Gould). Masked Wagtail. Occurs sparingly in the Indus valley.

32. **Motacilla alba hodgsoni.** Hodgson's Pied Wagtail. Common throughout the Indus valley.

33. **Motacilla cinerea caspica** (Gmelin). Eastern Grey Wagtail. Fairly common in the cultivated areas of the Indus valley.

34. **Motacilla citreola calcarata** (Hodgs.). Hodgson's Yellow-headed Wagtail. Very common on the Deosai Plain. A nest with four fresh eggs was found on July 17th. Not seen elsewhere in Baltistan.

35. **Anthus hodgsoni hodgsoni** (Richmond). Indian Tree-Pipit. Found breeding in the Deosai Mountains at 15,000 ft.

36. **Anthus roseatus** Blyth. Hodgson's Pipit. A nest with three young ones about a week old found on the Deosai Mountains at 14,000 ft.

37. **Otocorys alpestris deosai** Meinertz. Deosai Horned Lark. By far the commonest bird on the Deosai Plain. The place literally swarmed with them, and newly-fledged young were seen everywhere and were very tame, some being caught by hand.

38. **Alauda gulgula lahmarum.** Ladak Skylark. Occurs sparingly on the Deosai Plain on the higher cultivated and grazing grounds east of Skardu.

39. **Picus squamatus squamatus** Vigors. Scaly-bellied Woodpecker. Found sparingly in most of the Indus villages.

40. **Upupa epops epops** Linn. European Hoopoe. Occurs in all the Indus villages. Common round Skardu.

41. **Micropus apus pekinensis** (Swink.). Eastern Swift. A common bird in Baltistan. Seen daily both on the Deosai Plain and the Indus valley up to 15,000 ft. at least.

42. **Cuculus canorus telephonus** Heine. Asiatic Cuckoo. Heard calling daily on the Deosai Plain, usually from the tops of the most desolate hills. A young bird was seen at Skardu in the willows on the banks of the Indus.

43. **Gyps himalayensis** Hume. Himalayan Griffon. Found throughout Baltistan up to at least 16,000 ft.

44. **Haliaëtus leucoryphus** (Pall.). Pallas's Fishing Eagle. One bird was seen sailing high over the Deosai Plain, and two birds were seen on the Indus.

45. **Milvus migrans lineatus** (Gray). Black-eared Kite. Occurs sparingly around Skardu and neighbouring villages.

46. **Cerchneis tinnunculus** (sub-sp. *tinnunculus*?). A kestrel, probably the European Kestrel occurs throughout Baltistan. No specimens were obtained.

47. **Accipiter nisus melanoschistus.** Indian Sparrow Hawk. Seen on the Deosai Plain.

48. **Columba livia neglecta** Hume. Hume's Blue Rock-Pigeon. Very common throughout the Indus valley up to about 11,000 ft.

49. **Columba leuconota leuconota** Vigors. Snow Pigeon. One flock was seen feeding on the edge of a river on the Deosai Plain. Common above 12,000 ft. at Tseri. The note of this bird, always uttered when taking flight and alighting is a prolonged, high-pitched, and tremulous 'coo', rather reminding one of the note of the Common Myna when taking flight.

50. **Streptopelia orientalis ferrago** (Eversm). Himalayan Turtle-Dove. Common in all the Indus villages. All birds shot had the pure white under tail-coverts of the true 'ferrago'.

51. **Alectoris graeca chukor.** Meisner Chukor. Very common up to 10,000 ft. throughout the Indus valley especially near the villages. Very many coveys with half-grown young were seen, never numbering less than 35 birds in a covey and two pairs of adults.

52. **Tetrogallus himalayensis himalayensis** Gray. Himalayan Snow-Cock. This fine bird was first seen on the Deosai Mountains at 15,000 ft. It was very common in the Ibex ground above Tseri, as many as 40 being seen in one morning. Above Gol, too at 13,000 ft. it was frequently seen and heard. The wild ringing call, so well described by Osmaston (*B.N.H.S. Journal,* vol. xxxii, page 145) was a feature of the early mornings. The note was always uttered before taking flight and on the wing, and it was a magnificent sight to see half a dozen of these birds 'power-diving' across a ravine with the wind literally screaming through their wings. These aerial acrobatics which sometimes went on for a couple of hours seemed to be inspired by sheer exuberance.

53. **Cirrepedesmus mongolus atrifrons** (Wagler). Pamirs Lesser Sand-Plover. I thought I saw this bird twice on the Indus at Skardu, but unfortunately was unable to procure a specimen to make sure.

54. **Tringa hypoleucos** Linn. Common Sandpiper. A pair seen on the Deosai Plain, where they must have been breeding.

55. **Tringa totanus eurhinus.** Eastern Redshank. Heard calling at night on the Deosai Plain.

56. **Sterna hirundo tibetana** Saunders. Tibetan Tern. Two terns with very dark back and wings, like a black-backed gull, were seen on the Indus at Skardu. They were undoubtedly of this sub-species.

57. **Phalocrocorax carbo sinensis** (Shaw and Nod.). Large Indian Comorant. Five birds, evidently summer residents, were seen on the Satpura lake at 9,000 ft. One bird was also seen on the Indus.

58. **Casarca ferruginea** (Vroeg). Brahminy Duck. A flock of about 60 birds was seen on a sandy bank in the middle of the Indus near Skardu on July 24th.

RUNGLI RUNGLIOT P.O., W. H. MATTHEWS.
N. BENGAL.
January 22, 1941.

VII.—SOME NOTES ON BURMESE BIRDS.

1. **Smew.** (*Mergus albellus*).

While out fishing for Mahseer on the Nan Tebet (Myitkyina Dist.) below Chinkram in Nov. last year, I spotted what appeared to be 5 black and white duck and one rufous capped duck swimming about on the far side of the stream. Closer inspection convinced one that this was a party of 5 ♂ and 1 ♀ smew though unfortunately they never came close enough for me to have a shot at them. I could clearly see the white heads and necks of the drakes with black patches on their faces. The only other record of this bird's occurrence in N.-E. Burma is apparently from Fort Hertz.

2. **Glossy Stare.** (*Lamprocorax panayensis strigatus*).

Early one morning in Dec. last year, I noticed a large party of metallic green birds in a tall tree near Lake Hlawga, Rangoon. They were jumping and flying from bough to bough while keeping up an incessant chatter very much after the manner of Starlings or Mynahs. Although the only record of this bird is an uncertain one from Arakan, I can think of no other species to which these birds could have belonged.

3. **Burmese Black-crested Baza.** (*Baza leuphotes burmana*).

A female seen on her nest in a tall tree in open teak forest 6 miles down the Namkham road from Bhamo on May 9th 1941. It is reputed to be a very shy bird but I experienced the greatest difficulty in making it forsake its nest and only achieved this by continually throwing a stick up into the tree. Unfortunately I was unable to reach the nest which was on the tip of a slender branch.

4. **Daurian Redstart.** (*Phoenicurus hodgsoni*).

A ♂ specimen of what must have been this bird was shot by my friend Mr. Braund on a sparsely wooded hillside in the Hills between Kyaukme and Mogok (N.S.S.) in Feb. this year. This bird was in every way similar to the description given by Oates except that the areas given as 'chestnut' by him were much nearer 'chrome yellow'.

5. **Indian Blue-eared Barbet.** (*Cyanops duvauceli cyanotis*).

When out walking in open forest and scrub country near the river at Bhamo in May, I saw a small barbet hopping about on a

large bare tree. I managed to get up within 30 yards of it and clearly identified it as of this species. According to Smithies 'Birds of Burma' this bird has not hitherto been recorded from N.-E. Burma.

6. **Van Hassalt's Sunbird.** (*Cinnyris brasiliana*).

A ♂ bird seen at Lake Hlawga Rangoon in Sept. last year.

7. **Indian Grackle.** (*Gracula religiosa intermedia*).

4 birds seen in a bare tree in deciduous forest at plain's level 6 miles outside Bhamo in May this year.

8. **Sapphire-headed Flycatcher.** (*Muscicapula sapphira*).

♂ birds seen on two occasions on the road up to Bernardmyo near Mogok (March).

9. **Indian Sultan Tit.** (*Melanochlora sultanea sultanea*).

A ♂ bird seen in secondary growth on the hills behind Alexandra Barracks Maymyo Feb.

10. **Siamese Red-vented Bulbul.** (*Molpastes chrysorrhoides klossi*).

Red vented Bulbuls with light brown cheek patches have been seen by me both at Mogok (Feb.) and Bhamo (May). This cheek patch is so outstanding that I am sure both these birds were of the Siamese species.

11. **Yellow-throated Minivet.** (*Pericrocotus solaris solaris*).

A party of 8 was seen in a tree near Lake Hlawga Rangoon in December last year. This Minivet is not common in Burma and is normally a bird of the higher hills though the party seen by me was at sea level.

12. **Burmese Black-necked Tailor Bird.** (*Orthotomus atrigularis nitidus*).

I met a pair of these attractive little tailor birds in a low bush some 4 miles outside Bhamo in May this year and though I imagine they had a nest somewhere in the vicinity I was unable to locate it. This bird has been recorded from Myitkyina but has not so far as I am aware been seen in the Bhamo area before.

BHAMO, J. A. M. SYMNS.
May 24, 1941.

VIII.—BED BUGS AND SWIFTS.

In volume xli, No. 3 (April 1940) of the *Journal,* Humayun Abdulali has written an interesting note on 'Swifts and Terns at Vengurla Rocks' (Misc. Note No. xi). He describes finding the

Swifts' nests as 'all swarming with a bug which proved on identification to be the common bed bug *Cimex rotundatus'*. Vidal is also recorded as having taken these bugs from the nests of swifts, and Dr. Annandale is reported to have collected specimens of this bug at Calcutta from the nests of the swift.

In an excellent article—'Confessions of a Hunter: Know your animal before you raise your gun', by Roy L. Abbott, Professor of Biology, in the February 1940 issue of 'Natural History' the following para occurs: 'A neighbour's boy and I used to stand for hours 'plinking' with a .22 rifle at the swallows and chimney swifts that sported around our old barn. They were under the ban because they carried bed-bugs. We never learned that the so-called 'Bed-bugs' associated with these beautiful birds were not bed bugs at all; nor did we ever discover that the Chimney Swifts built their pretty little nests in our chimney by gluing sticks together with their own saliva'.

The above article has also been reproduced in Part xl, *Journal of the Society for the Preservation of the Fauna of the Empire,* (August 1940). Can it be that the bugs found in the nests of the Vengurla Swift, and also by Vidal and Dr. Annandale, have been incorrectly identified too—that they are not the true bed bug: as apparently is now known of the swifts in the U.S.A.?

TOBRUK, R. C. MORRIS.

CYRENAICA, LIBYA.

April 19, 1941.

[The insects taken from the swifts' nests at Vengurla were identified at the Indian Museum, Calcutta, as *Cimex rotundatus,* the Bed Bug. EDS.]

IX.—OCCURRENCE OF SWINHOE'S SNIPE IN ASSAM.

Since writing to you on November 8th I have shot two more Swinhoe's Snipe (*Capella megala*), making five bagged in the season. The first was at Haltea, about ten miles south-west of Silchar, on April 24th, and the second was shot in a valley some three miles east of Shillong, on May 2nd. Both were solitary birds, though I bagged some pintail snipe on the same day.

I can confirm Mr. Clough's statement that the Swinhoe's Snipe is slightly larger than the average pintail.

BRIGHTWELL, J. C. HIGGINS.

SHILLONG, ASSAM.

May 26, 41.

X.—HABITS OF THE SEESEE PARTRIDGE.

With reference to my notes in the last number of the *Journal* on the habits of the Seesee Partridge (*Ammoperdix g. griseogularis*) I would now like to add that the remarks as to the silence of these

birds apply only to Waziristan apparently. Formerly I had not shot them outside this Agency and here they do not call either on the ground or on taking off. However last week I was shooting near Attock, and there I heard Seesee calling frequently, much as Chuckor do though not of course the same call note. It could not be reproduced as Seesee however. They also uttered an alarm note when put up which I have never heard up here. They were in addition considerably wilder and got up as a rule at about 30 yards.

TOCHI SCOUTS,
MIRANSHAH,
N. WAZIRISTAN, N.W.F.P.
February 20, 1941.

T. J. PHILLIPS.

XI.—RAT-SNAKES FIGHTING.

At 8 o'clock this morning I was informed that cobras were mating in an adjoining garden. I hastened across with a stick to find a pair of Rat-snakes or Dhamans (*Ptyas mucosus*) stretched out at length on the ground under a mango, entwined round one another as when mating. Closer investigation, however, showed that they slithered up and down each other's lengths, and the front part of their bodies raised a foot above the ground, swayed to and fro. People had been watching this for quite a time, and I was begged to destroy these venomous snakes. One was killed and an attempt to catch the other resulted in my holding its tail, while about 2′ of its front portion took refuge in a pile of stones. Two people bracing their feet against the stones, were unable to dislodge the animal, and this was eventually too badly injured to be preserved alive.

Dissection revealed that they were both males, one 7′ 6″ and the other 8′ 3″.

Several people had been watching the proceedings for at least 40 minutes, and everybody was certain that the snakes were mating. The chances are that the males were fighting, but no attempt was made to bite each other. It might be interesting to examine other pairs of snakes apparently *in coitu*.

ANDHERI,
May 6, 1941.

HUMAYUN ABDULALI.

XII.—THE MATING INSTINCT *versus* SELF PROTECTION.

(*A Snake and Toad Incident*).

On Sunday the 8th instant, I watched a 2½′ *Natrix piscator* devouring a toad (*Bufo*). A closer examination showed two toads, apparently *in amplexu*. The snake had seized the lower one (female) by the hind legs, and had swallowed about half. The male still

hung on to the female, ignoring the snake whose head was now under its belly! The snake continued to swallow, the male uttering an occasional feeble note. When the snake reached the female's armpits, the male lost interest, calmly stepped off her back and slowly hopped away. I then picked him up and he protested vociferously. An attempt to catch the snake made him disgorge the toad whose hind legs lay stretched out behind her. I did not examine her very closely, but I believe she was dead. Two more *piscator* were seen in a morning's walk, a large one swimming across the stream, apparently carrying a toad (or frog), and a small 10″ youngster which hopped off the ground several times, in a vigorous attempt to escape. The monsoon had just broken.

This was in north Salsette, along the Dahisar Nadi.

BOMBAY, HUMAYUN ABDULALI.
June 11, 1941.

XIII.—SUPPOSED CANNIBALISM AMONG SPIDERS IN HIGH ALTITUDES.

In the 'Comity of Spiders' p. 118, Bristowe quotes Hingston as saying that the spiders found on Mt. Everest at 22,000 feet are the highest existing animals on earth . . . . and for food they eat one another. Bristowe doubts this cannibalistic regime, and suggests that thorough search would reveal springtails and other small insects under stones. This receives confirmation from Eric Shipton who told me last year (August 1940) that in July 1935 he found fish insects under rocks collected to build a cairn at the summit of a peak of the Mt. Everest group, height 22,580 feet. (Lat. N. 28° 04′ Long. E. 86° 54′). These and probably other forms of *Aptera* evidently provide food for the spiders on Mt. Everest.

The same solution of the food problem for spiders is to be found in caves. *Collembola,* and rarely *Campodea,* are to be found in Indian lime stone caves. Cave spiders are present remote from the entrances in caves on Moila Tibba near Chakrata. The large adults make webs and apparently depend for food on hatches of fungus gnats, and the chance arrival of insects for hibernation. They live in a very sluggish and semi-comatose state. The immature spiders are however very active, and are to be found running about the cave floor in those situations where *Collembola* (and millepedes) occur.

GEODETIC BRANCH OFFICE, E. A. GLENNIE,
SURVEY OF INDIA, *Colonel,*
DEHRA DUN, U. P. *Regional Recorder (India & Burma),*
March 19, 1941. *British Speleological Association.*

XIV.—EXTENSION OF THE KNOWN RANGE OF THE BEETLE *ALLOMYRINA DICHOTOMUS* INTO ASSAM.

While I was in Darjeeling during the summer of 1940 I made a small collection of stag beetles for Mr. Gilbert Arrow, F.R.E.S., of the British Museum (Natural History) and sent them to him. As I do not know very much about beetles, a number of Dynastidae were sent along with the stag beetles (Lucanidae). He has just sent me a list of identifications, as follows, of the 15 specimens sent:—

Lucanidae:

Nos. 1-4 *Calcodes castanopterus,* ♂ and ♀.
5 *Dorcus fulvonotalus,* ♂.
6 *Dorcus reichei,* ♂.
7 *Dorcus curvidens,* ♀.
8 *Dorcus antaeus,* ♀.
9-11 *Calcodes baladeva,* ♂ and ♀.

Dynastidae:

12 *Eupatorus hardwickei,* ♂.
13 *Dynastes gideon,* ♂.
14 *Allomyrina dichotomus,* ♀.
15 *Eupatonus hardwickei* var *cantori,* ♂.

Speaking of the specimens of *Allomyrina dichotomus* ♀, he writes: 'No. 14 is of very particular interest to me, as it has never been recorded as an Indian species. . . . . . It is known only as a Chinese and Japanese insect and its discovery in Darjeeling is surprising. . . . . The male of *Allomyrina dichotomus* is an extraordinary insect with an enormous head-horn, broad at the end, with four points. I should very much like to see an Indian example. It may prove to differ to some extent from the typical form.'

There is no possibility of any mistake over this addition to the Indian Coleoptera for all the specimens were caught alive and killed personally by me.

DIBRUGARH,
LAKHIMPUR DISTRICT,
ASSAM.
April 12, 1941.

R. E. PARSONS,
F.R.E.S.,
Indian Police.

XV.—A NOTE ON THE ROOT-PARASITISM OF *CENTRANTHERA HUMIFUSA* WALL.

Centranthera belongs to the family *Scrophulariaceae,* and is allied to the genera *Striga* and *Sopubia,* most species of which are known to be root-parasites. The members of the genus *Centranthera* are described in the *Flora of the Presidency of Madras* as 'probably

more or less parasitic', but little or no definite information appears to be available about the parasitism of the South Indian species.

Centranthera humifusa Wall. is not uncommon on the margins of ponds and in other marshy places in the Chingleput District, flowering during the N.-E. monsoon season. It is a small, more or less prostrate herb with stems and leaves rather like those of a striga, but the calyx is spathaceous, and the corolla is funnel-shaped, about .6 in. long, with yellow lobes and reddish-brown striated tube. There are several rather stout main branches to the root system; these branches may be several inches long, are orange in colour, and their surface is finely ridged longitudinally. From these main branches numerous white or almost white thread-like secondary branches spread. These when they come in contact with the slender rootlets of certain other plants attach themselves by small roundish suckers. These suckers are not terminal, as in some root-parasites, for the thread-like rootlet continues and may attach itself to a whole series of rootlets of other plants. Much less frequently a main branch of the root system may be found attached to the root of another plant by a larger haustoria. No root hairs were found on the rootlets of this plant, and so the root-system appears to be entirely parasitic in function. This plant grows in marshy places where the ground is densely occupied by grasses, sedges and other marsh plants, and where the soft wet soil is consequently traversed by a tangled network of rootlets. The fine rootlets carrying the suckers are brittle and the suckers usually separate easily from the host. Consequently, it is difficult to trace the host plant with certainty. Connection was, however, traced to two sedges (*Fimbristylis dichotoma* Vahl and *F. polytrichoides* R. Br.) and to two grasses, one of which was *Iseilema laxum* Hack. The haustoria were also found attached to the nitrifying nodules on the roots of *Desmodium triflorum* DC.

This plant does not appear to be sufficiently common in this district nor sufficiently large to be harmful to crops.

E. BARNES.

MADRAS CHRISTIAN COLLEGE,
TAMBARAM,
CHINGLEPUT DIST.,
S. INDIA.

January 25, 1941.

PROCEEDINGS OF THE ANNUAL GENERAL MEETING OF THE BOMBAY NATURAL HISTORY SOCIETY.

The Annual General Meeting of the Members of the Bombay Natural History Society was held on Wednesday evening, the 25th June 1941, at 6-15 p.m. at the B.E.S.T. Lecture Hall, Electric House, Fort, Bombay, Rt. Revd. R. D. Acland, Lord Bishop of Bombay, presiding.

AGENDA.

1. Reading of the Annual Report of the Committee.
2. Presentation of the Balance Sheet and Statement of Accounts for the past year.
3. Election of the Committee.
4. Such other business as may be properly brought before the Meeting.

The Honorary Secretary announced the election of 57 new members since the last meeting held on 18th April 1940:—

Mr. A. H. Baker, Bombay; Mr. F. Hessling, Bombay; Rev. R. A. Wilson, Kolhapur; Mr. John H. S. Rawson, North Perak, F.M.S.; Mr. F. J. Connell, Bombay; Mr. F. R. E. Malden, Khaur, Punjab; Mr. C. F. Hoey, Darjeeling; Mr. B. D. Mirchandani, I.C.S., Nadiad; The Superintendent, Municipal Gardens, Byculla, Bombay; The Honorary Secretary, East Indian Railway European Institute, Allahabad; Mr. W. P. Keelan, Dehra Dun; Mr. J. D. Michael, Simla; The Principal, V. V. Training College, Sandhurst Road, Bombay; The Principal, Bengal Agricultural Institute, Tejgaon, Dacca; Mr. B. A. Buckwell, R.A., R.A. Mess, Meerut; Mrs. A. B. M. Way, Jullundur Cantt., Punjab; Shrimant Raja Saheb N. T. Patwardhan of Miraj State; H. H. Sri Jayachamaraja Wadiyar Bahadur, Mysore State; The Commissioner of Agriculture, Baroda State; Mr. W. Meiklejohn, I.F.S., Darjeeling; Major E. J. Palairet, Quetta; Dr. S. Kamesam, B.E., Bangalore; The Director, Tawaza Department, Srinagar, Kashmir; The Conservator of Forests, Orissa, Angul; Major W. E. Merrill, I.A., Dehra Dun; The Director, Indian Forest Ranger College, Dehra Dun; Mr. Madhavlal M. Bhatt, J.P., Bombay; The Conservator of Forests, Holkar State, Indore; Mr. Antonio Vieira Velho, Nova Goa; The Conservator of Forests, N.W.F.P., Abbottabad; Mr. J. A. Douglas, Dehra Dun; Miss A Avdall, Calcutta; The Secretary, Bengal Club, Ltd. Calcutta; The Biology Teacher, Woodstock School, Mussoorie, U.P.; Mr. E. Lehner, M.A., Ph.D., Khodaung, Upper Burma; Mr. E. P. Wiltshire, Shiraz; Mr. E. B. Glenn, Calcutta; The University Librarian, University Library, Mysore, S.I., Mr. D. D. Belayew, Baghdad; The Conservator of Forests, Baroda State; The Station Executive Officer, Kharagpur; Mr. T. R. Stobart, B.Sc., Bombay; Mr. H. B. Gabb, Darjeeling; The Registrar, University of Travancore, Trivandrum; H. E. General Sir Claude Auchinleck, Simla; Kumar Sures Singh Kalakankar, Oudh; H. H. Shri Bhimsinghji Sahib Bahadur, Maharao of Kotah; Mr. R. V. E. Hodson, I.P.S., Government House, Peshawar; The Director, Bose Institute, Calcutta; Mr. James McFarlane, Calcutta; H. H. Maharaja Anandrao Puar Sahib Bahadur, Dhar, C.I.; Mr. M. T. Bam, Meerut; H. E. The Governor of Sind, Karachi; Mrs. S. F. Jarman, Bombay; Mr. J. S. Ker, Calcutta; Miss Maud E. Wolfe Murray, Nilgiris; The Honorary Secretary, Allahabad Club, Ltd., Allahabad.

BOMBAY NATURAL HISTORY SOCIETY.

Office Bearers—1941.

The following gentlemen were elected to serve on the Managing Committee for the ensuing year:—

President.—H. E. Sir Roger Lumley, G.C.I.E., D.L.

Vice Presidents.—H. H. The Maharao of Cutch, G.C.S.I., G.C.I.E.; Rev. Father J. F. Caius, S.J., F.L.S.; Rt. Revd. R. D. Acland, M.A.

Executive Committee.—Mr. Farrokh E. Bharucha; Mr. A. Forrington; Mr. J. B. Greaves, C.B.E., M.L.A., J.P.; Mr. M. J. Hackney; Mr. R. E. Hawkins; Mr. D. H. Hill, F.R.G.S., J.P.; Dr. M. Sharif, D.SC., Ph.D., F.N.I.; Lt.-Col. S. S. Sokhey, I.M.S.; Mr. F. Wadia; Mr. H. M. McGusty (*Hon. Sec. and Treasurer*).

Advisory Committee.—Mr. Salim A. Ali; Dr. C. F. C. Beeson, D.SC., M.A., I.F.S.; Lt.-Col. R. W. Burton, I.A. (*Retd.*); Mr. C. H. Donald, F.Z.S.; Dr. F. H. Gravely, D.SC., Mr. C. M. Inglis, B.E.M.E.O.U., F.Z.S.; Mr. R. C. Morris, F.R.G.S., F.Z.S.; Major E. G. Phythian Adams, F.Z.S., I.A.; Dr. Baini Prashad, D.SC.; Mr. H. C. Smith, I.F.S.; Lt.-Col. C. G. Toogood, C.I.E., D.S.O.; Mr. J. H. Williams.

Staff.—S. H. Prater, M.L.A., J.P., C.M.Z.S. (*Curator*); and C. McCann, F.L.S. (*Assistant curator*).

The proceedings concluded with an interesting lecture by Mr. S. H. Prater on 'The Region of Perpetual Night'.

The lecturer developed his theme very interestingly describing first the various factors which affected animal life in the depths of the sea. Prominent among these is the absence of the sunlight and the consequent absence of plant food, the terrific pressure from the weight and volume of water, freezing cold and diminished supplies of oxygen. The lecturer showed how deep sea animals had adapted themselves to life under these adverse conditions. The lecture was illustrated by an interesting series of Lantern Slides and of models of deep sea fishes prepared in the Museum laboratories.

ANNUAL REPORT OF THE BOMBAY NATURAL HISTORY SOCIETY FOR THE YEAR ENDING 31ST DECEMBER, 1940.

ADMINISTRATION.

President.—H. E. Sir Roger Lumley, G.C.I.E., D.L.

Vice-Presidents.—H. H. The Maharao of Cutch, G.C.S.I., G.C.I.E.; Rev. Fr. J. F. Caius, S.J., F.L.S.; Rt. Revd. R. D. Acland, M.A.

Executive Committee.—Mr. Farrokh E. Bharucha; Mr. A. Forrington; Mr. J. B. Greaves, C.B.E., M.L.A., J.P.; Mr. M. J. Hackney; Mr. R. E. Hawkins; Mr. D. G. Hill, F.R.G.S., J.P.; Dr. M. Sharif, D.SC., Ph.D., F.N.I.; Lt.-Col. S. S. Sokhey, I.M.S.; Lt.-Col. W. C. Spackman, I.M.S.; Mr. F. Wadia; Mr. H. M. McGusty (*Hon. Secretary and Treasurer*)—Bombay.

Advisory Committee.—Mr. Salim Ali, Dehra Dun; Dr. C. F. C. Beeson, D.SC., M.A., I.F.S., Dehra Dun; Lt.-Col. R. W. Burton, I.A., (Retd.), Bangalore; Mr. C. H. Donald, F.Z.S., Dharamsala; Dr. F. H. Gravely, D.SC., Kodaikanal; Mr. C. M. Inglis, B.E.M.B.O.U., F.Z.S., Darjeeling; Capt. R. C. Morris, F.R.G.S., F.Z.S., Coimbatore; Major E. G. Phythian Adams, F.Z.S., I.A., Nilgiris; Dr. Baini Prashad, D.SC., Calcutta; Mr. H. C. Smith, I.F.S., Maymyo; Lt.-Col. C. G. Toogood, C.I.E., D.S.O., Dehra Dun; Mr. J. H. Williams, Coimbatore.

Staff.—S. H. Prater, M.L.A., J.P., C.M.Z.S. (*Curator*); C. McCann, F.L.S. (*Assistant Curator*).

THE HONORARY SECRETARY'S REPORT FOR THE YEAR 1940.

The Society's Journal. The forty-first Volume of the Journal was completed during the year and the first number of Volume XLII was published.

MAMMALS.

The large collections obtained during the Society's Mammal Survey have provided the basis for numerous papers leading to the

revision of Blanford's standard work on Indian Mammals in the Fauna of British India Series. The first volume of the revised edition dealing with the Primates and the Carnivores was published in 1939, under the authorship of Mr. R. I. Pocock. The author now continues his preliminary studies, and during the year we published two papers by him dealing with the Hogbadgers and Otters of British India. Hogbadgers, whose name aptly describe their curious appearance, are not found in Peninsular India, but are fairly widely distributed to the north and east of the Bay of Bengal. There has been considerable difference of opinion about the status and correct nomenclature of the many forms and species, described by various authors. Blanford, accepting the views of certain previous writers, recognized two Indian species—The Large Indian Hogbadger (*Arctonyx collaris*), found in the Eastern Himalayas and Burma, and a smaller animal (*A. taxoides*), confined more or less to Assam and Arrakan. Pocock, accepting the verdict of recent American authorities, recognizes but a single species, represented in the various areas of its wide range by racial forms. His conclusion is based on a study of examples of practically all the hitherto described forms, which, though they do not provide complete evidence of intergradation, yet offer sufficient evidence to support his view. Two races of the Hogbadger occur in India—the typical form (*A. collaris collaris*), which inhabits the Sikkim Terai, the Bhutan Duars and Assam, and a second form, with a larger head and body, which Pocock describes as a new sub-species under the name *A. collaris consul.* It is found in Assam, Burma, and Tenasserim.

Pocock's paper on Indian Otters is again an attempt to clear the confusion around this group of animals. It is almost impossible, from the plethora of names and vagueness of descriptions, to fix the identity of the various species. The three Indian species included in Blanford's work under the genus *Lutra* are now separated under three distinct genera: *Lutra,* the so-called Common Otter, *Lutrogale,* the Smooth Otter, and *Amblonyx,* the Clawless Otter. An interesting point connected with the distribution of otters in India has been brought to light as a result of the study of the material collected by the Society's Mammal Survey. It has been discovered that the distribution of the Common Otter and the Clawless Otter is parallel to the discontinuous distribution of the Thar and the Pine Marten, which are found in the Himalayas and nowhere else in India, except in the hill ranges of the south. Similarly, these two otters occur both in northern and southern India, but are absent from the central area of the Peninsula. Mr. Pocock in his paper describes two new races—the South Indian form of the Clawless Otter (*Amblonyx cinerea nirnai*), and a desert race of the Smooth Otter (*Lutrogale perspicillata sindica*) from Sind.

The pages of the Society's *Journal* where sportsmen and naturalists for half-a-century have recorded their observations have become an encyclopaedia from which one may now write the natural history of many Indian animals. Such is Col. R. W. Burton's paper on the Indian Wild Dog. It is a *resumé* of all that has been recorded

in the *Journal,* over the space of 50 years or so, on these interesting animals. Among other matters discussed, is the old question, so often raised by sportsmen, as to whether there is a large and small race of wild dog in India. Packs of females, which are slighter in build, with their young, have probably given rise to the notion. Fresh evidence that wild dogs can be tamed, if taken in hand very young, is provided. The subject was first raised in our *Journal* some 40 years ago, when a writer, who made the experiment, said that for 'gameness, staunchness and invincible tenacity', he was convinced that there was no breed of domestic dog to compare with his domesticated wild ones.

Questions put to the Society often lead to investigations which produce interesting results. Some time ago we received an enquiry from the Editors of the *Encyclopaedia Britannica* as to the number of tigers shot annually in India. While there are no reliable means of ascertaining the numbers of tigers killed in open forests, reasonably correct data can be obtained relative to forests under State control. The figures made available by the Chief Conservators of Forests with the various Provincial Governments and States, show that approximately 650 tigers were killed in controlled forests in India, in the year 1937-8. The enquiry also shows that tigers are more numerous in the forests of northern India, particularly in the United Provinces. The numbers are well maintained in the Central Provinces, but, as one goes farther south, there is a distinct decrease in the tiger population. Another interesting point is that there appears to be a far larger number of males than females. In Northern and Central India, the proportion averages at about 2 to 1. A similar predominance in the number of males was revealed by actual censuses taken some years ago in Palamau Division of Behar. Lastly it has been shown that the granting of rewards for shooting tigers or their withdrawal has had little effect on the numbers shot in British India. The whole subject is discussed in a note by Mr. Prater, the Society's Curator, published during the year under review.

Mr. McCann's contributions to the *Journal* are always interesting. His papers include one on the Fulvous Fruit Bat (*Rousettus leschenaulti*) in which he discusses the life history and habits of a species, which is not an uncommon pest in orchards and fruit gardens in Western India. His study of the feeding habits of this bat supports the discovery he made a few years ago when investigating the food of the flying-fox. His conclusion is that these large fruit bats do not absorb solid food. All that passes into their stomachs is nectar, or the juices of fruit masticated by them. Solid pulp, seeds and skins are rejected through the mouth. The litter under a tree where fruit bats have been feeding is this rejected matter. There is after all a substratum of truth in the popular Indian belief that flying-foxes and bats excrete through their mouths.

Birds.

The Ornithological Survey of Mysore State was completed during the year. The work was undertaken with the co-operation

of the American Museum of Natural History, New York, which paid part of the costs. Financial assistance was also received from the Mysore Government. Reports embodying the results of the Survey will shortly be published in the *Journal*. Of the many bird surveys carried out by the Society, this was perhaps one of the most successful. Our thanks are due to Mr. Salim Ali, who had charge of the work, and to various officials and friends in Mysore who assisted him. In the course of the last ten years or so the Society's Ornithological Surveys have covered the greater part of India. They have been directed particularly to areas which were little known ornithologically. They have helped substantially to provide a truer picture of the status and distribution of Indian birds. Like the Mammal Survey for mammals, these Bird Surveys undertaken by the Society have made more imperative a revision of the standard work on the Indian avifauna. During the year under review we published Part II of the Birds of Central India, being reports of surveys carried out by Mr. Ali in Bhopal, Gwalior, Indore, and Dhar.

Burmese birds feature in notes on the Birds of Nattaung, Karenni District, contributed by Messrs. H. C. Smith, P. F. Garthwaite, and B. E. Smythies, Burma Forest Service. The birds of the Karen Hills have been the subject of scattered notes and observations, and the present paper provides the first connected account of the bird life of this interesting zone. We should like to take this opportunity to congratulate the writers of this paper on their recently published book on *The Birds of Burma*—an excellent work which summarizes the present day knowledge of Burmese birds, and gives in simple language an account of the ways and habits of the various species. Coloured illustrations of 290 species, excellently done, quite apart from their attractiveness, supply exactly what is wanted by laymen. The people of Burma are indeed fortunate in having this well written and well illustrated work on the bird life of their Province, which serves as an attractive guide and is well directed to increase interest in and knowledge of Burmese birds.

A feature of our *Journal* during recent years has been Mr. E. H. Lowther's well written and beautifully illustrated notes on Indian Birds. Mr. Lowther's enthusiasm as a camera hunter and his enjoyment of birds and their ways enlivens what he writes. We are glad indeed that we have been able to persuade him to publish his notes and fine pictures—a thing he was at first very reluctant to do. His 'Sportsman's Gallery' which we published during the year gives charming pictures of some of our commoner game birds. A second article by Mr. Lowther is associated with many happy memories of camera hunting in the Manbhum District, revived here in vivid description and in excellent pictures.

Fishes.

Three parts of Dr. Hora's serial on the Game Fishes of India were published. They deal with the Mahseers. The Large-scaled

Barbels collectively known as 'Mahseer' include a number of species and forms about whose status and correct distribution there is little exact knowledge. All anglers know of the mighty Mahseer, *Barbus tor*. But which particular species answers to its description, and where is this true Mahseer found? In the present state of our knowledge it is not possible to be precise as to the range of *Barbus tor* in the rivers of India. All that can be said is that this particular species is widely distributed in the rivers and streams debouching from the Himalayan foot hills into the adjoining plains. A second species *Barbus* (*tor*) *mosal* appears to be commoner in Burma than in the Himalayan streams. A third north Indian species dealt with by Hora is the Bokar of the Eastern Himalayas and Assam, *Barbus l. hexagonolepis*. Coloured illustrations and descriptions of these species are included in Dr. Hora's papers.

The intensive development of irrigation in the Punjab, involving the construction of masonry dams and weirs across its rivers, has had an adverse effect on its inland fisheries. Many species of food fishes living in those rivers are migratory. During the breeding season, they ascend to the higher reaches for spawning. The dams and weirs constructed for irrigation purposes have become serious obstacles to the spawning movements of the fishes. It is true, that the weirs are provided with fish ladders to permit the upward passage of fish, but Dr. Hamid Khan's investigations have shown that most of the ladders, from their faulty construction, serve little practical purpose. The weirs and dams remain a serious obstacle to spawning movements. The effect is increasingly demonstrated in the very considerable reduction in the stock of fishes in the upper reaches of the rivers. Barriers to spawning movements, ineffective provision for surmounting them, and last but not least the whole-sale indiscriminate slaughter of fishes in the canals during the close season, are all factors responsible for the steady deterioration of the inland fisheries of the Province. While the supply of water for the development of irrigation is supremely important, there is little reason for the needless sacrifice of a valuable source of food supply. In his paper Dr. Hamid Khan shows what is wrong with the existing fish-ladders, and what should be done to make them serve the purpose for which they were constructed. His recommendations deserve the serious consideration of the Government.

Detailed information of the life history of larvicidal fishes, particularly of species of proved utility in the destruction of mosquito larvae are essential to the practical use of these natural agents. A paper published under the joint authorship of Messrs. S. Jones and T. Job describes the earlier stages in the development of the Deccan Killifish (*Apolcheilus lineatus*), a species reported to be ot special value in mosquito control. The habits of a second larvicidal species (*Horaichthys setnai*) are discussed in a second paper by T. Job, from observations made on fry collected in the backwaters of Cochin and Travancore. The author's conclusion is that this species is suitable for use in malarious coastal areas and that it is particularly effective in destroying mosquito larvae in the earlier stages of development.

Reptiles.

Mr. McCann's reptile and amphibian miscellany contains a wealth of notes and observations on crocodiles, lizards, and frogs. You might quite easily come upon Mr. McCann prowling around his house in the dead of night looking for lizards with an electric torch. For many months, a pet crocodile occupied the damp quarters behind his bath tub, tortoises make free use of his garden, while frogs and toads in homely aquaria, not to mention crowded jars of pickled reptiles, are prominent in the decorative scheme of his house. But of such stuff are naturalists made and from such enthusiasm is derived the intimate knowledge that Mr. McCann has brought to his very interesting paper. His notes on the food, breeding habits, and development of common Indian reptiles form the substance of his miscellany. They add much to the little that is known about even the commonest species.

Worli Hill, one of the seven Islands which went into the making of our fair city of Bombay, has been the subject of study by various geologists, most recently by the late Mr. J. Rebeiro, who published the results of his work in our *Journal.* Below the thick mass of morum and trap which make up the dome of the hill lie highly interesting sedimentary deposits in which the most persistent fossil is the frog. The presence of these frogs indicate that the deposits were originally laid in freshwater, suggesting that what subsequently became an island was once part of the mainland. The frogs have been described by various authors, and, because of their toad-like characters, were included by Noble in a special genus, *Indobatrachus*. Specimens collected by Mr. G. W. Chiplonker of the Hindu University, Benares, are described by him as a new species under the name *Indobatrachus trivialis*.

Invertebrates.

Butterflies and Moths.—Part II of Major-General Sir Harry Tytler's Notes on New and Interesting Butterflies from Burma was published during the year. Owing to the death of the author the manuscript of this part was edited by Mr. G. Talbot, who also corrected the proofs of both parts. The present part deals with the *Nymphalidae, Erycinidae* and *Lycaenidae,* and contains descriptions of 32 new races. Capt. W. C. Carrott continued his notes on the butterflies of the Shan States and added supplementary data to his original paper published during the previous year. In 1931, we published an account of the butterflies of the Simla hills by Mr. G. W. De Rhe-Phillipe, much fresh information made available subsequently has made revision of the original paper necessary. This work was undertaken by Mr. M. A. Wynter-Blyth with the assistance of Mr. A. E. Jones. The present paper covers an area roughly corresponding with the Simla Hill States and records some 277 species. Reference is also made to species known from the surrounding territory, which are likely to be met within the area—in all the paper provides a very useful and up-to-date working list. The authors acknowledge their indebtedness to Brigadier

Evans for his help in identifying many of the species listed by them. Students and collectors in India, studying the earlier stages of Indian butterflies and moths are frequently handicapped by the lack of any information about the food plants of caterpillars. Mr. D. G. Sevastopulo's informative article on the food plants of Indian Bombyces is therefore welcome. It summarizes such information as the author has been able to find on the food plants of the caterpillars, adds supplementary information from personal experience and makes suggestions from what is known of the feeding habits of allied species in other countries.

Mr. G. C. Bhattacharya wrote an interesting account of what he describes as the 'Death March of the Hibiscus Caterpillars.' An orderly procession of caterpillars was seen moving in single file—their objective a mimosa plant growing in an earthen pot. The procession climbed the wall of the pot and arrived on its circular rim. Following the circle, the leading caterpillar soon found itself at the tail-end of the procession. Its ingrained instinct to follow in the wake of the preceding caterpillar compelled it to follow the procession. In a persistent circle the procession travelled day and night, till one by one its members dropped dead from exhaustion, the last survivors of the interminable journey succumbing on the 6th day. The processionary instinct, highly effective in bringing the caterpillars to their destination proved disastrous in the novel circumstances in which they found themselves. They were unable to deviate by a hair's breadth from an instinctive mode of behaviour. They followed its tyrannical urge even unto their own destruction.

Economic Entomology is represented by a paper on the Wax Moth (*Achroia grisella*), a pest of honeycombs. The authors, Messrs. M. C. Cherian and S. Ramachandra, discuss the status of the moth as a pest in the Coimbatore District and suggest control measures. The distribution, life history, and habits of *Galerucida bicolor,* a minor pest of cultivated yam, were recorded by Dr. T. V. Ramakrishna Ayyar.

Much has been written on the courting habits of spiders. The perils braved by the male in courting the female, usually his superior in physique and prowess, has no parallel in the animal kingdom. Not infrequently the too presumptuous male meets his death and is added to the larder of his mistress. Such tragic courtship is however not as universal among spiders as is generally stated. Among some tribes, the relation between the sexes is more pacific and may even approach domesticity. Among the Leaping Spiders (*Attidae*) courtship takes the form of a love dance. Professor Montgomery in his interpretation of this dance believes that even this apparently nonchalant behaviour of the male is prompted by fear and that the antics of the dance are for the most part exaggerations of the spider's ordinary reaction to fear and timidity. Mr. Mathew, in his interesting study of the courtship of an Attid Spider (*M. plataleoides*), shows that in this species the antics of the male are the ordinary 'on guard' movements which the spider carries out normally in the face of any suspected danger. The female is not immediately recognized, as the eyes of the male give it, at any distance, but a vague impression of what confronts it.

But, in circumstances where the male is sure that it is dealing with a female of its own species, such as when it takes a female in its nest, or is familiarized with her presence as co-captives in a cage, the dance is dispensed with. The partners come to terms without the preliminary demonstration. The male of this spider is stronger and more powerfully built than the female and has no special reason to fear her, but nevertheless he adopts his defensive attitude till recognition is completed by actual contact with his desired partner.

Botany.

The three parts of Father Caius's serial on Medicinal and Poisonous Plants published during the year deal with the very large family of Composites and with the Flaxworts. It has been said that there is no plant drug used in medicine the world over which cannot be grown and produced in India, and yet India continues to be largely dependent on external supplies for her needs. The exigencies of war have however given a great impetus to the development of local products. Such data as the author is now providing in his papers on local medicinal plants is a timely and valuable contribution to the development of Indian plant products.

Mr. N. L. Bor continues his serial on Beautiful Indian Climbers and Shrubs. When completed these articles will be produced as a companion volume to the book by Blatter and Millard on *Beautiful Indian Trees*. The last named work is now out of print and we are unfortunately unable to meet the many demands made on us for copies. A second edition under present conditions would mean a considerably enhanced cost. We must wait for better times. We anticipate the same demand for Mr. Bor's work when it appears in book form and the question of expediting publication of the serial in the *Journal* by issuing a larger number of parts is now being considered. Another serial in course of publication in the *Journal* is M. Sayeedud-din's work on Common Indian Herbs. Parts 3, 4 and 5 were published. We also commenced publication of a work on the Flora of the Punjab by Dr. T. A. Sabnis. The work is based on the author's study of the plant collections in the Herbarium of the Forest Research Institute, Dehra Dun, and incorporates notes made by the various collectors.

Ecological methods can be applied to many different branches of animal or plant biology. This is a wide and almost virgin field in India both for zoologists and botanists, we therefore welcome Mr. S. V. Ganapati's study of the conditions in a temple tank which are conducive to the development of an algal pest, *Microcystis aeruginosa,* which is found in permanent bloom in many tanks in Madras City. The death and decay of these plants not only affect the taste of the water, but also give it a characteristic foul odour. The author discusses the physical and chemical conditions which favour the development of these algal growths. In the particular tank studied, the most important factors favouring development were the high temperature of the water, absence of movement, and the high content of phosphates and organic manurial elements. Parallel studies of the physical, chemical, and biological conditions

of the many ponds in Madras, which contain this pest, would help to disclose the reasons for its permanent productivity and for the periodically malodorous condition of the water. Apart from its scientific interest, such a study would be of decided significance from the health point of view.

Shooting and Fishing.

Shikaris who have never bagged a rogue elephant and would like to, are recommended by Mr. Hall to go to Assam as the most likely spot for realizing the ambition. In his very entertaining and vigorous style Mr. Hall describes his adventures with rogue elephants in Assam, down to the grand *finale* enacted in a village, at night in pyjamas and slippers. The meeting of Mr. Hall and the elephant in the pitch blackness of a rainy night amid a frantic chorus of screaming, panic-stricken men, women and children, and the subsequent happenings have all the spice of adventure that the most exacting could wish for. In the same number we published Major Phythian-Adams' account of small game shooting in Mysore. Particularly interesting are the author's records of game shot over a number of years. They reveal that Pintail Snipe occur in far larger numbers than Fantail in Southern India; among duck, the Spot-bill is the commonest, Shoveller and Pintail making a bad second and third; among the migratory Teal, the Garganey appears in much the larger numbers, while among the resident species, the Cotton Teal is the most common. In all, the State affords quite good opportunities for small game shooting, and the author shows what these opportunities are, and how they can best be enjoyed.

Col. R. W. Burton, to whose account of the ways of wild dogs we have already referred, contributed three other articles to the *Journal*. These deal with fish and fishing. His Mahseer River of Southern India is the beautiful Bhavani, or rather, that stretch of it, some 10 miles above Mettupalaiyam where the river debouches from a rocky gorge into an open valley and, for 25 miles or more, becomes wonderful fishing water. August and September is the time of the year for fishing in it. Col. Burton writes as one who knows our streams and forests, as well he may, having taken, for so many years, so much of his pleasure from them. The story of his visit to the Laccadive Islands makes equally delightful reading and provides those who would like to spend a holiday off the beaten track with useful and interesting information. There are coral reefs to explore, blue lagoons to fish in, *barracouda* and other tough game fish in the seas around, and friendly islanders and skilled fishermen for company. Col. Burton's last article has to do with Sword fish in the seas off New Zealand. It is a far cry from the coasts of India; but big-game fishing is one of the many attractions that New Zealand has to offer to its visitors. We take this opportunity of thanking Col. Burton for his effort to provide popular reading in the *Journal*. Col. Burton is one of the Society's 'old guard,' his first contribution to our pages was written 35 years ago. During all the intervening years he has frequently shared his varied reminiscences of sport in the Indian jungles with our readers.

We have constantly expressed the hope that more of our members would do this. It is true we are living in much more rigid times when leisure hours are fewer. But the charms of the jungle and the wild will always remain and those who enjoy them may yet share their good fortune with the many who cannot. Accounts of shooting, fishing, and travel are always welcome in our *Journal*. If you have experiences to write about, please send them to us.

PUBLICATIONS.

Snake charts.

During the year we brought out a new edition of the Snake Chart. It has since been made available to most of the Hospitals and Dispensaries in India, and to many Schools and Colleges.

Poisonous Land Snakes of India.

A book on the Poisonous Land Snakes of India is in course of preparation and we hope to publish it during the present year. Part I of this work which contains descriptions of our poisonous snakes has been written by Dr. Malcolm Smith of the British Museum. Part II, which has to do with snake poisoning and its treatment will be the work of Dr. Burgess Barnett, the author of recent discoveries relative to the use of Russell's Viper's venom as a blood coagulant in surgery. Wall's Poisonous Terrestrial Snakes, which was published by the Society and which ran into four editions has long been out of print. The new book will provide a modern standard work on a subject of much interest both to doctors and laymen in India.

The Book of Indian Birds.

This year will also see the fulfilment of a long cherished plan to provide a moderately priced and well illustrated book on Indian Birds. The Book of Indian Birds by Salim Ali exactly supplies this need. It contains 171 full page picture plates in colour, numerous photographs and simple readable accounts of the habits, food, and nesting of the common birds seen about towns and villages in the plains of India and around our coasts. People have always wanted a book like this. The Society has now provided it.

Birds of Bombay and Salsette.

Of more local interest is the work on the Birds of Bombay and Salsette which appeared in the *Journal* in serial form and which has now been issued as a Museum Pamphlet with the series of other pamphlets dealing with the Fauna of Bombay and Salsette.

Nature Calendar.

In 1941, for the first time, the Society published a Natural History Calendar. It was an eleventh hour decision, but in spite of this the 1,300 copies which we issued were sold out almost as soon as they appeared, and many late applications had to be turned down. The illustrations, for which we are indebted to Major R. S. P. Bates, Mr. E. H. N. Lowther, Mr. T. R. Hubback, and Major C. L. Boyle were of course the making of the calendar,

and we hope we may rely on the support of these gentlemen in the production of future efforts along similar lines. The 1942 Calendar is already in course of preparation, and there is every reason to believe that this will prove an increasingly popular innovation.

Revenue Account.

Our total income for the year was Rs. 29,340-10-6 as against Rs. 27,091-9-0 in 1939, an increase of Rs. 2,249-1-6, but even so we failed to meet expenses by Rs. 3,548-10-4. Fortunately we carried forward a surplus of Rs. 5,000 from the last balance sheet, and enquiries received to date indicate that Salim Ali's Bird Book is going to be a marked success. The Society's Calendar was also very well received, and I think we can view the coming year without any misgivings.

Membership.

4 members died during the year. Only 25 members resigned as against 44 new members who joined; but we have written off 41 members who have not paid their subscriptions for some years. Total membership is 810 compared with 836 at the end of 1939.

Acknowledgments.

The Council of the Society would like to record its appreciation of the continuous help which the Society has received from Mr. W. S. Millard. Ever since he left India in 1919, and relinquished his post as Honorary Secretary, Mr. Millard has continued his interest in the Society and has given it invaluable assistance particularly in connection with printing of plates and publications issued by the Society in London. On behalf of the members of the Society we offer him our sincere thanks.

Our sincere thanks are also due to Mr. Theodore Hubback for the generous contributions he has made to cover the cost of plates issued with his interesting articles on Malayan Wild Life. Mr. Hubback's interest in the work of the Society and the assistance that he has repeatedly given us is deeply appreciated.

Staff.

The Committee wish to record their appreciation of the good work done by the Curator and his staff during the past year.

15th April, 1941.

H. M. McGUSTY,
Honorary Secretary.

BOMBAY NATURAL HISTORY SOCIETY.

BALANCE SHEET AS AT 31st DECEMBER 1940.

LIABILITIES	Rs A P	Rs A P
Life Membership fees :		53,375 0 0
Donations for specific purposes unexpended :		
Show Cases, Models of Fish, etc. in Prince of Wales Museum—Account No. 1 ...	241 10 7	
Show Cases, etc., in New Building, in Prince of Wales Museum—Account No. 2.	145 15 11	
Special Journal Fund	669 14 10	
Ornithological Survey	1,488 5 0	
		2,545 14 4
Sundry Creditors :		
Mr. E. C. Stuart Baker: Game Books ...	542 7 0	
Brig. W. H. Evans, Account Butterfly Books	113 8 10	
The Diocesan Press, Madras, Journal Account	2,128 6 7	
The Diocesan Press, Snake Chart Account	3,569 4 0	
The Times of India, Ltd., Calendar Account	833 8 0	
For Expenses (Audit Fee)	250 0 0	
		7,437 2 5
Donation from H.E.H. Nizam for Expenses :		5,000 0 0
Surplus Assets :		
Balance as per last Balance Sheet ...	32,073 15 11	
Less.—Loss on Revenue Account	3,570 4 1	
		28,503 11 10
Total ...		96,861 12 7

ASSETS	Rs A P	Rs A P
Investments—At holding value or Market value whichever is lower :—		
Rs. 35,000 3½% Loan 1947-50 at 102¼% ...	35,787 8 0	
,, 15,000 5% do. 1945-55 at par ...	15,000 0 0	
,, 10,000 3% do. 1951-54 at 98% ...	9,800 0 0	
,, 14,000 4% Bombay Port Trust Bonds at 77%	10,780 0 0	
,, 15,000 4% Bombay Improvement Trust Bonds at 76%... ...	11,400 0 0	
,, 5,000 3½% Pro-Note 1854-55 (out of donation received from H. E. H, Nizam)	4,997 4 7	
Rs. 94,000		87,764 12 7
Cash—		
With National Bank of India, Ltd., Bombay, (inclusive of Rs. 2-11-5 out of donation received from H.E.H.Nizam.)	953 11 0	
With National Bank of India, Ltd., London, £19-18-2 at 1/6	265 7 1	
On hand	250 0 0	
		1,469 2 1
Sundry Debtors :		3,359 3 0
Advances to Staff :		180 0 0
Expenditure on Book Climbing Shrub ...	354 8 4	
Expenditure on Bird by Salim A. Ali ...	2,109 2 7	
		2,463 10 11
Furniture :		
As per last Balance Sheet	1,502 0 0	
Less Depreciation	27 0 0	
		1,475 0 0
Publications excluding Journals :		
Stock on hand as certified by the Hon. Secretary		150 0 0
Total ...		96,861 12 7

Note.—A stock of 21,450 old Journals and the valuable research collection and Library of 2,675 volumes have not been taken into account on the asset side of the Balance Sheet.

We have prepared the above Balance Sheet from the Cash Book and from the information given to us, and have verified the Investments.

In our opinion such Balance Sheet represents a true and correct view of the state of the Society's affairs according to the best of our information and the explanations given to us.

(Sd.) A. F. FERGUSON & CO., *Chartered Accountants, Auditors.*

(Sd.) H. M. McGUSTY, *Honorary Treasurer.*

BOMBAY NATURAL HISTORY SOCIETY.

REVENUE ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1940.

Dr.	Rs A P	Rs A P	*Cr.*	Rs A P	Rs A P
To Salaries	19,020 0 0		By Subscriptions	16,652 14 2	
,, Society's Contribution to Staff Provident Fund	1,480 0 0		,, Entrance Fees	460 0 0	
,, General Charges	107 2 2		,, *Sales of :*		
,, Rent	2,436 0 0		Old Journals	678 10 0	
,, Stationery and Printing	255 2 0		Game Books, Vols. I, II & III ...	542 7 0	
,, Postage	776 14 4		Society's Publications	26 7 10	
,, Library	216 7 2		Snake Charts	4,709 6 3	
,, Audit Fee	250 0 0		Calendars	224 7 6	
,, Fire Insurance	187 8 0		Bird Albums	1,315 0 0	
,, Depreciation on Furniture	27 0 0		,, Interest on Investments	3,231 14 0	
,, Cost of Printing Journals	8,233 3 2		,, Profit on outside works	1,577 14 0	
		32,989 4 10			29,419 0 9
			Loss carried to Balance Sheet		3,570 4 1
Total ...		32,989 4 10	Total ...		32,989 4 10

PUBLICATION ACCOUNT FOR THE YEAR ENDED 31st DECEMBER 1940.

	Rs A P	Rs A P		Rs A P	Rs A P
To Book on Climbing Shrubs:					
Expenditure to 31st December, 1939 ...	353 5 4				
Expenditure during the year to 31st December, 1940	1 3 0				
		354 8 4	By Balance carried to Balance Sheet ...		354 8 4
,, Book on birds by Salim A. Ali:					
Expenditure during the year to 31st December, 1940		2,109 2 7	,, Balance carried to Balance Sheet ...		2,109 2 7
,, Printing Charges on Snake Charts ...	5,790 0 9				
Profit carried to Revenue Account ...	4,709 6 3				
		10,499 7 0	,, Sale Proceeds of the Snake Charts ...		10,499 7 0
,, Printing Charges of Calenders ...	1,011 8 6				
Profit carried to Revenue Account ...	224 7 6				
		1,236 0 0	,, Sale Proceeds of Calendars		1,236 0 0

Dr. Cr.

INCOME AND EXPENDITURE ACCOUNT OF DONATIONS FOR SPECIFIC PURPOSES FOR THE YEAR ENDED 31st DECEMBER, 1940.

	Rs A P	Rs A P		Rs A P	Rs A P
Fund No. 1					
To Expenditure on Fish Gallery, etc. ...	95 0 0		By Unexpended Balance as per last Balance Sheet		336 10 7
,, Balance carried to Balance Sheet ...	241 10 7	336 10 7			
Show Cases Fund No. 2					
,, Balance carried to Balance Sheet ...		145 15 11	,, Unexpended Balance for Show Cases in New Building as per last Balance Sheet		145 15 11
Special Journal Fund					
,, Expenditure on Journals	2,215 6 6		,, Unexpended balance (Special Journal Fund) as per last Balance Sheet ...		2,885 5 4
,, Balance carried to Balance Sheet ...	669 14 10	2,885 5 4			
Ornithological Survey					
,, Expenditure on Ornithological Survey ...	1,058 3 0		,, Unexpended balance as per last Balance Sheet		2,546 8 0
,, Balance carried to Balance Sheet ...	1,488 5 0	2,546 8 0			

BOMBAY, *15th March, 1941.*

Examined and found correct.
(Sd.) A. F. FERGUSON & CO.,
Chartered Accountants, Auditors.

(Sd.) H. M. McGUSTY,
Honorary Treasurer.

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THE

JOURNAL

OF THE

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REV. J. F. CAIUS, S.J., F.L.S., H. M. McGUSTY,
AND S. H. PRATER, M.L.A., C.M.Z.S.

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THE SOCIETY'S PUBLICATIONS.

Birds.

Game Birds of India, Vol. II. (Woodcock, Snipe, Bustards, and Sandgrouse) 1st Edition. **Rs. 42.**
(*Price to Members Rs.* 30).

Game Birds of India, Vol. III. Pheasants, 1st Edition. **Rs. 28.**
(*Price to Members Rs.* 17).

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(*Price to Members Rs.* 10).

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(*Price to Members Rs.* 3).

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(*Price to Members Rs.* 10-8).

Snakes.

Identification of Poisonous Snakes—
Hanging Wall Chart, 30″×40″. (Revised in 1940). **Rs. 5.**
Folding Pocket Chart. **Rs. 1-12.**

Snakes of Bombay Island and Salsette, by S. H. PRATER, C.M.Z.S. **Re. 1.**

Miscellaneous.

Game Fishes of Bombay, the Deccan and the Neighbouring Districts. By Sir REGINALD SPENCE, KT., F.Z.S., and S. H. PRATER, C.M.Z.S. With colour and black and white illustrations. **Rs. 2.**
(*Price to Members Rs.* 1-8).

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(*Price to Members Rs.* 10).

Wall Chart to distinguish a Wild Dog from a Domestic Dog or Jackal, etc. **Rs. 2-8.**

A List of Indian Butterflies, by COL. W. H. EVANS. **Rs. 2.**

Wood-Destroying White Ants of the Bombay Presidency, by JOSEPH ASSMUTH, S.J. **Re. 1.**

Back Numbers of the Journal.

Back numbers of the Society's Journal. Rates on application.

TERMS OF MEMBERSHIP.

Life Members pay an entrance fee of Rs. 10 and a Life Membership fee of Rs. 350.

Ordinary Members pay an entrance fee of Rs. 10 and an annual subscription of Rs. 25.

The subscription of members elected in October, November and December covers the period from the date of their election up till the end of the following year.

MEMBERS RESIDING OUTSIDE INDIA.

The terms are the same for members living outside India. Such members should pay their subscriptions by means of orders on their Bankers to pay the amount of the subscription, plus postage—in all Rs. 26-8-0—to the Society in Bombay on the 1st January in each year. If this cannot be done, then the sum of £2-0-6 should be paid annually to the Society's London Bankers—The National Bank of India, Bishopsgate Street, London, E.C.

CONTENTS OF VOLUME XLII, No. 4

Large-flowered Thunbergia
THUNBERGIA GRANDIFLORA Roxb.
($\frac{2}{3}$ nat. Size.)

JOURNAL
OF THE
Bombay Natural History Society.

1941. Vol. XLII. No. 4.

SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS.

BY

N. L. Bor, M.A., D.SC., F.L.S., I.F.S.,

Forest Botanist,

AND

M. B. Raizada, M.SC.,

Assistant Botanist,

Forest Research Institute, Dehra Dun.

Parts VIII and IX.

(*Continued from Vol.* xlii, No. 3 (1941), p. 471).

Part VIII.

(*With* 1 *coloured and* 5 *black and white plates and* 10 *text-figures*).

Thunbergia Retzius.

The genus *Thunbergia* was erected by Retzius in honour of Karl Peter Thunberg, professor of Botany at Upsala, who died in 1828.

The species of *Thunbergia* (family Acanthaceae) are mostly tall perennial climbers which are favourite garden plants on account of the beauty and profusion of their flowers. They are extensively cultivated in all parts of the world and in India, where several are indigenous. A good many species are hardy out of doors and are extremely decorative if grown to the best advantage.

Characters of the genus.

The leaves are opposite, petiolate (sessile in *Thunbergia natalensis*) on the usually swollen joints of the stems, rarely subentire, more usually lobed or toothed in various ways; the nerves are, in

most cases, palmate, i.e. they arise and spread from the top of the petiole. The flowers are large and showy and are arranged in terminal pendulous racemes or solitary or in pairs in the axils of ordinary leaves. Each flower is temporarily enclosed in a spathe consisting of two large bracteoles cohering along the margins. The calyx is very short, sometimes a mere rim, or, more often, crowned by 10 to 15 teeth. The corolla has a narrow or widely infundibuliform, often curved, tube ending in five sub-orbicular lobes all spreading, or a campanulate and strongly curved tube arising from the short cylindrical or conical base ending in five lobes of which the upper two are erect. The stamens are four in number usually in pairs with filaments of different lengths, inserted in the lower portion of the tube and included. The anthers are two-lobed and are glabrous or with a fringe of hairs along the margins, or the lobes bearded at the base or furnished with a crest of hairs; sometimes one or both lobes spurred. The ovary is seated upon a large annular disk, which is often larger than the ovary. The ovary is 2-celled with 2 collateral ovules in each cell; style straight or curved, surmounted by a stigma which may be obconical in shape or, more often, distinctly 2-lipped, with the upper lip erect and the lower spreading. The pollen grains are globose, without germ pores, but with one or more often spirally twisted grooves. The fruit is shaped rather like a bird's head and consists of a globose 2-celled capsule crowned by a stout beak. On dehiscence the beak splits violently from apex to base and the seeds are flung out. The seed is semiglobose in shape with a large pit on the inner side.

The brightly coloured flowers of the species of *Thunbergia* are an indication that the process of fertilisation is carried out through the agency of insects. The construction of the flowers however is such that only insects with certain characteristics are suitable for the purpose.

Taking the flower of *Thunbergia grandiflora* as an example, it will be observed that it can be divided into three portions; a lower conical portion which directly surrounds the ovary and nectary, a tubular-ventricose portion which carries the four stamens in a groove on its upper surface, and the spreading lobes. The spreading lobes are usually brightly coloured and their function is merely to attract an insect. The tubular portion is important as the transference of pollen must take place within it. As already stated the four stamens lie together in a groove on the upper surface of the corolla tube. On the lower surface of the tube inside is a bulge corresponding to a groove on the outside. This bulge ensures that the back of any visitor is pressed well up against the anthers on the roof. The anthers of the upper pair of stamens are pressed closely together and form a convenient groove in which lies the style. The anthers of the lower pair lie on either side of the upper pair. The style itself expands into the cup-shaped stigma a little in advance of the stamens. The filaments of the stamens though compressed are swollen at the base and the four of them are so placed that they practically block the entrance to the chamber in which the ovary is situated. A small foramen is left

through which passes the style. The anthers are bearded with long thin hairs and bear one or two horny hooks on their posterior margins. The nectary which secretes the honey is a fleshy disk surrounding the ovary.

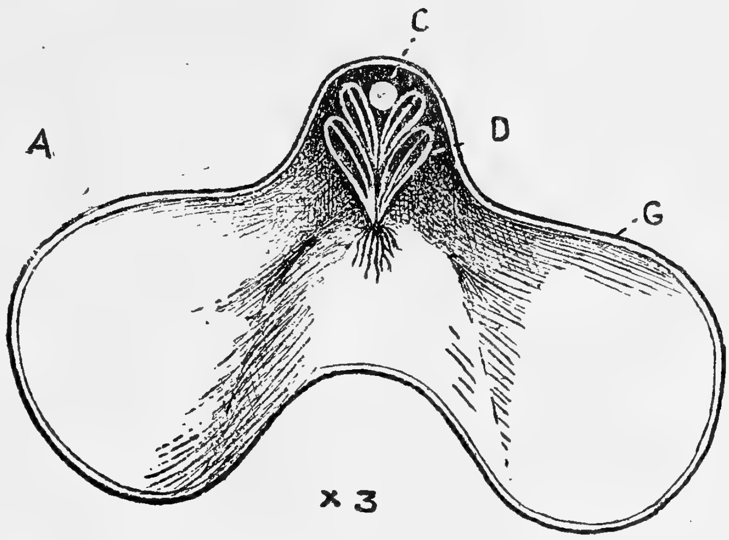
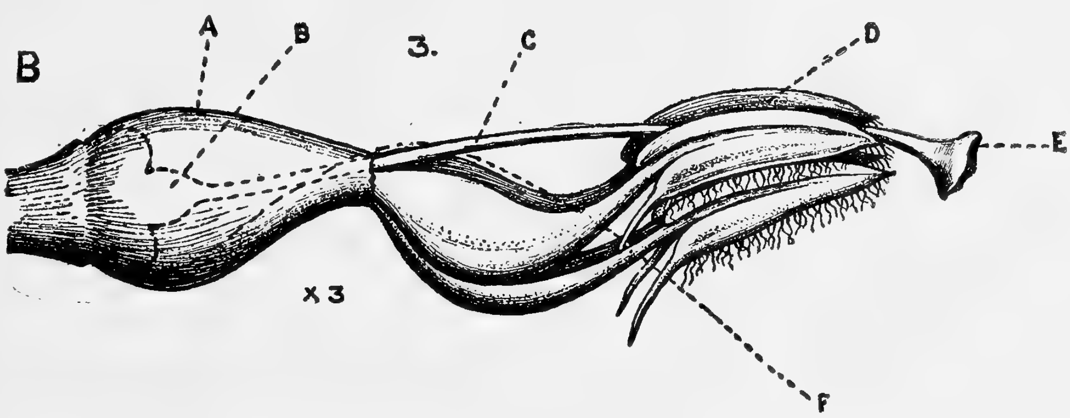


Fig. 1. A.—Cross section of corolla showing position of style and stamens; note the curvature of the corolla which ensures that the insect will touch the stamens.



B.—Side view of stamens ovary and style; corolla tube removed. A, base of corolla; B, ovary-seated on nectary disc; C, style; D, stamens; E, stigma; F, path to honey which must be followed by proboscis of insect; G, corolla.

The first thing that happens when an insect visits the flower is that its dorsal surface touches the viscous lower lip of the stigma which is pressed down and any pollen which the insect is carrying is transferred. The insect pushes on still further and comes into contact with the hooks on the anther, which results in pollen being shaken down upon its back and thorax. Owing to the smallness of the hole at the base of the stamens and its distance from the honey only insects with a long proboscis can reach the booty. The proboscis must be passed upwards over

the style and then downwards to reach the honey. As the insect retreats its pollen-dusted back presses up the lower non-viscous edge of the stigma and prevents self-fertilisation.

Burkill[1] observed the process of cross-fertilisation in this species in Calcutta and discovered that the agents were *Xylocopa latipes* and *X. aestuans*. The bodies of these bees just fit the antrum of the flower and the proboscis is sufficiently long to reach the honey. He observed that the dorsal surfaces of the insects were dusted with pollen on their emergence from the flower. A further refinement in the mechanism of pollination is when the stigma has two lips the lower of which is non-receptive. This lip touches the back of the insect and drags down the upper receptive lobe which duly collects the pollen from the back of the visitor without any danger of self-fertilisation.

Fig. 2.—Front view of stamens ovary and stigma with portion of the corolla cut away. (See Fig. 1. for explanation of lettering.)

KEY TO THE SPECIES.

Flowers axillary, solitary.
  Petioles winged. ... ... *T. alata.*
  Petioles wingless.
    Colour of flowers white ... ... *T. fragrans.*
    Colour of flowers blue or purple.
      Plant erect.
        Leaves petiolate ... ... *T. erecta.*
        Leaves sessile ... ... *T. natalensis.*
      Plant climbing. ... ... *T. grandiflora.*

Flowers in terminal or axillary racemes.
  Flowers blue.
    Leaves broadly ovate, cordate at the base. ... *T. grandiflora.*
    Leaves ovate oblong to lanceolate-oblong, rounded at the base. ... ... *T. laurifolia.*
  Flowers yellow. ... ... *T. mysorensis.*
  Flowers scarlet. ... ... *T. coccinea.*

[1] Burkill, I. H., *J.A.S.B.* (1906) 511-14.

Thunbergia alata Boj.

BLACK-EYED SUSAN.

(*alata* is a Latin word meaning winged and refers to the wings on the petiole).

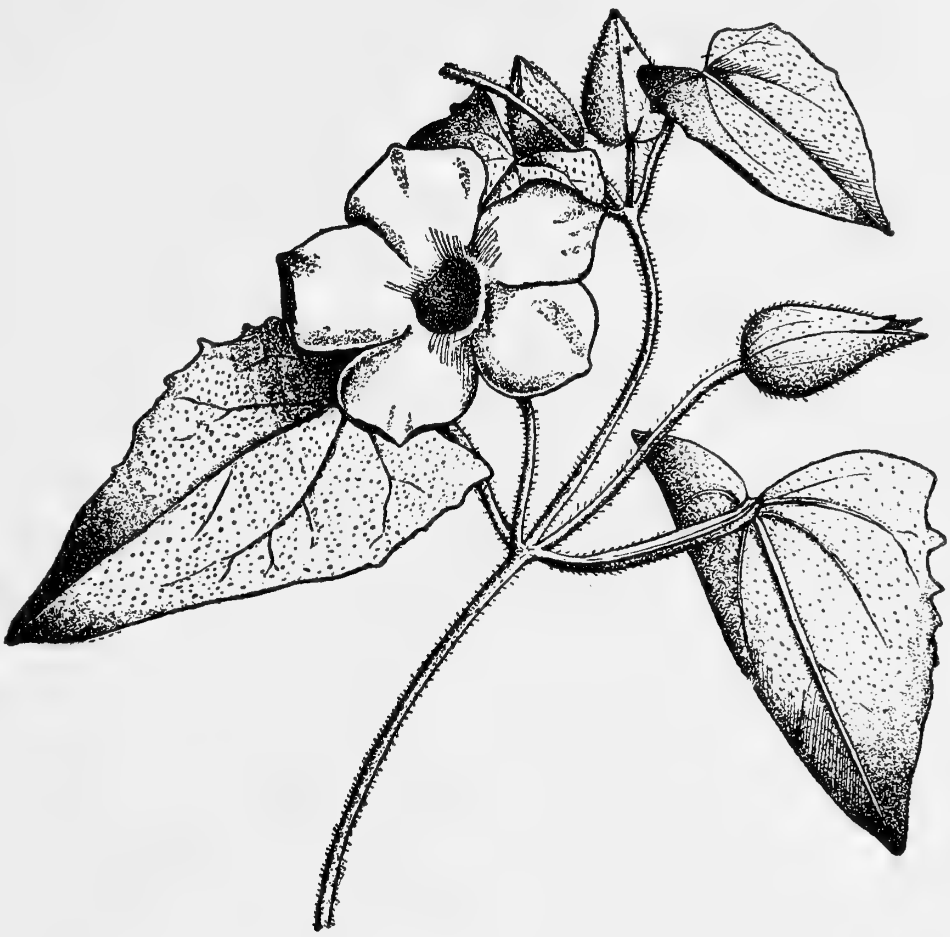


Fig. 3.—*Thunbergia alata* Boj. $\times \frac{3}{4}$.

Description.—A slender herbaceous twiner with very hairy shoots. Leaves opposite, seated on a narrowly winged petiole which is often as long as the blade, sagittate in shape, up to 2 in. long by 1.75 in. wide, acuminate, pubescent on both surfaces and hirsute on the nerves beneath; margin entire, undulate, with one or two broad teeth on either side. Flowers axillary, seated on peduncles which are shorter than the subtending leaves. Bracteoles spathe-like, ovate, apiculate, pubescent on both surfaces and hirsute on the margins, persistent, about 0.5 in. long. Calyx very short, bowl-shaped, surmounted by 10 subulate lobes, covered with glandular hairs. Corolla tube infundibuliform, 0.75 in. long and 0.2 in. wide in the throat, ending in five yellow, orange or rarely white lobes, deep claret coloured in the throat. Stamens four, one pair of filaments shorter than the other; anthers of the lower pair with two spurs, those of the upper with only one spur, densely fringed along the margin and at the base with long club-shaped hairs. Ovary seated in a cup-shaped disk; style 0.5 in. long; stigmas 2-lipped, the upper lip about twice as long as the lower but much narrower.

Flowers.—September-November. Fruits cold season.

Distribution.—Native of south-east Africa. Cultivated or naturalised throughout India.

Gardening.—This twiner closely resembles *Thunbergia fragrans,* but is softly villous and has winged petioles and usually yellow flowers with a brown or purple eye or sometimes shades of buff or orange or even white. It is well suited for a small trellis-work. Propagated usually by seeds. There are several varieties but the following are commonly seen in cultivation:—

Thunbergia alata Boj. var. *alba* Paxt. has white flowers with a blackish centre.

Thunbergia alata Boj. var. *aurantiaca* Kuntze is a variety with bright orange flowers having a dark centre.

Medicinal use.—In Malaya the leaves are made into poultices which are applied to the head to relieve headaches.

Thunbergia fragrans Roxb.

(*fragrans* is Latin for fragrant. Why this epithet should have been applied to this plant, which has odourless flowers, is not known).

Description.—A slender herbaceous twiner with scabrid, or more or less glabrescent, shoots. Leaves opposite on slender

Fig. 4.—*Thunbergia fragrans* Roxb. ×1/1.

wingless petioles which are usually shorter than the blade, lanceolate, or triangular-ovate, cordate or subcordate at the base, almost hastate, up to 2.5 in. long by 1 in. wide, toothed on both sides

Photo by M. N. Bakshi

Thunbergia fragrans Roxb.
New Forest, Dehra Dun.

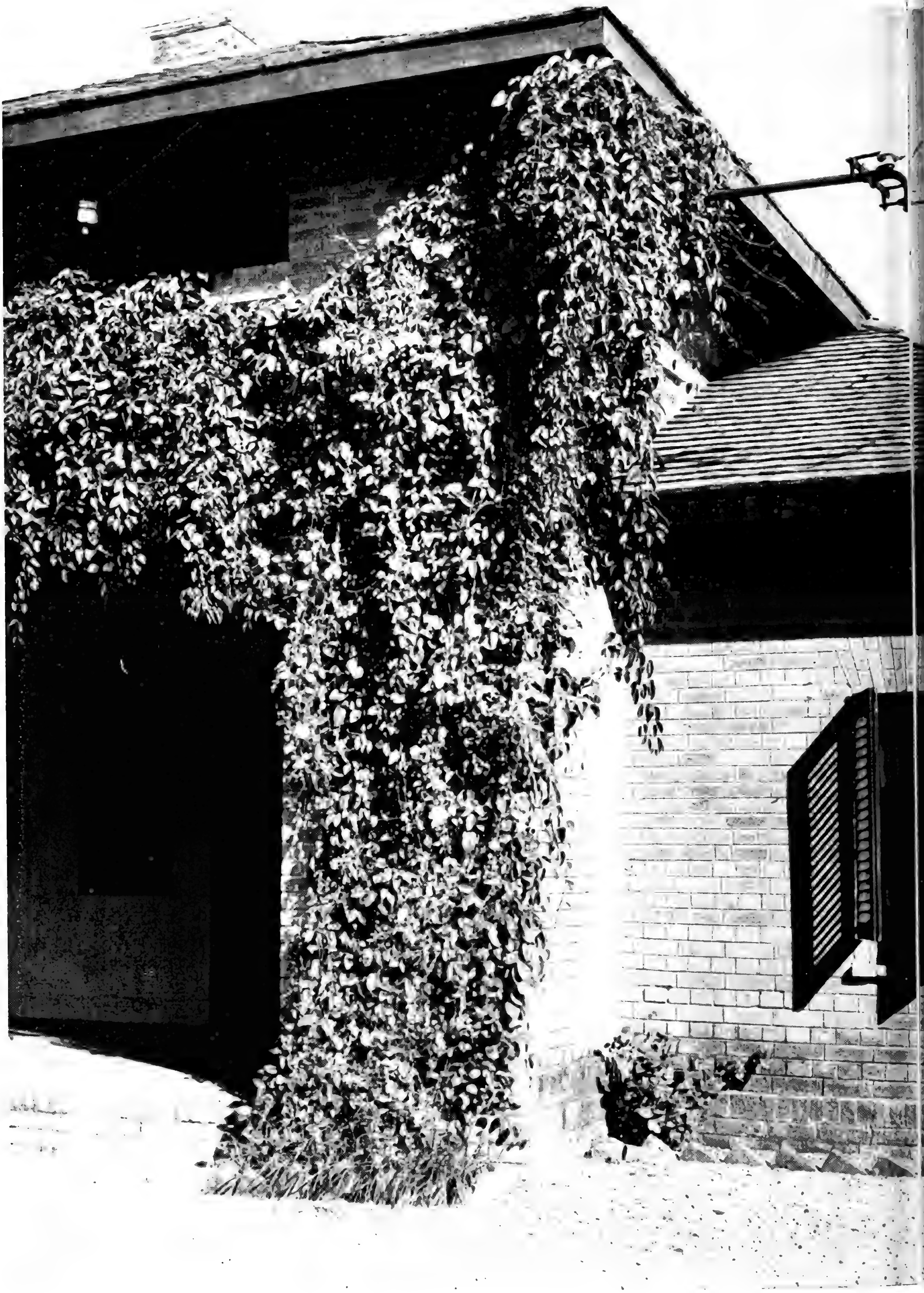


Photo by *M. N. Bahi*

Thunbergia fragrans Roxb.
New Forest, Dehra Dun.

at the base, more or less rough on both surfaces, palmately 5-nerved. Flowers axillary on peduncles which are usually longer than the subtending leaf. Bracteoles spathe-like, ovate or ovate-lanceolate in shape, less than 0.75 in. long, persistent. Calyx bowl-shaped, very short, surmounted by 15 subulate teeth, glandular-pubescent. Corolla tube infundibuliform, about 1 in. long, white and without fragrance, lobes spreading about 0.75 in. in diameter. Stamens in pairs, the filaments of one pair as long as those of the other which are about 0.5 in. long; anthers entirely glabrous and without spurs. Ovary seated in a disk; style nearly 1 in. long; stigma 2-lipped, the upper lip slightly longer and narrower than the lower lip. Capsule scabrid. Seeds reticulate.

Flowers.—September-November. Fruits cold season.

Distribution.—Throughout India and Malaya.

Gardening.—A herbaceous climber with beautiful snow-white flowers. Easily propagated by seed which it produces abundantly. It is suitable for growing over a screen. Contrary to what the specific name would seem to denote, the flowers are not fragrant.

Thunbergia erecta (Benth.) T. Anderson

(*erecta* is Latin for upright and refers to the habit of the species).

Description.—This species is a small shrub which in Indian gardens reaches a height of about 4 feet. The shoots are quadrangular in section and each angle bears a narrow wing, glabrous when old but the younger are covered with a mantle of short crisp hairs near the nodes; buds in the axils of the leaves densely covered with short golden or reddish hairs. Leaves opposite, exstipulate, but connected at the base by a raised ridge across the node, petiolate (petiole 0.1 in. long), ovate-elliptic, acute and apiculate, subacute at the base, glabrous, penninerved but the first pair often arise near the base; margin entire, undulate, or occasionally with a broad triangular tooth above the middle. Flowers axillary, solitary or paired, seated on peduncles up to 1.5 in. long, usually much less. At the top of the peduncle are a pair of greenish white bracteoles, spathe-like, early or tardily deciduous. Calyx very short, bowl-shaped, surmounted by 15 subulate calyx-teeth, densely covered with gland-tipped hairs. Corolla tube 1.5-2.5 in. long, glandular outside, slightly conical at

Fig. 5.—*Thunbergia erecta* (Benth.) T. Anderson × $\frac{1}{2}$

the base swelling above, infundibuliform, curved, ending in five subequal lobes; yellowish white at the base, central portion cream shading into the dense violet lobes and mouth, ochre-coloured in the throat. Stamens four, in pairs, the filaments of one pair 0.5 in. long, of the other 0.4 in. long, covered with short gland-tipped hairs. Anthers shortly awned or mucronate, with a thick fringe of hairs along the margins. Ovary seated in an annular disk. Style up to 1.5 in. long; upper lip of the stigma erect and folded, the lower spreading and very broad.

Flowers.—Chiefly during the cold weather.

Distribution.—Native of west tropical Africa, but is a very common cultivated plant in gardens throughout India.

Gardening.—A hardy shrub, very pretty when in full bloom during the cold season. It thrives best in bright sunshine and is well adapted to the topiarist's art. Easily propagated by cuttings during the rains. It was introduced into India from Kew in 1859.

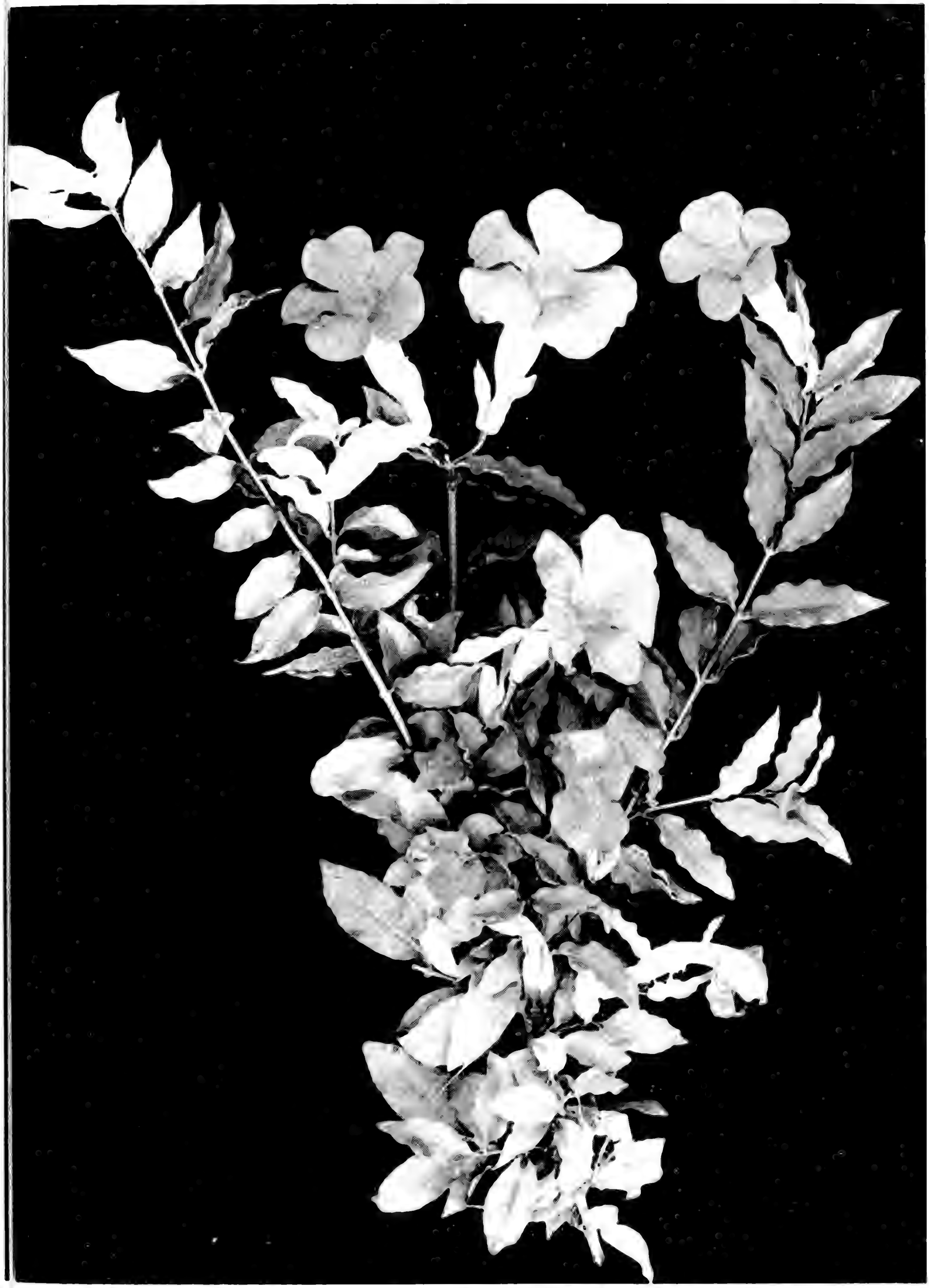
Thunbergia erecta (Benth.) T. And. var. *alba* is a variety with white flowers, but it is by no means as beautiful as the type.

Thunbergia natalensis Hook.

(The specific name refers to the home of the plant).

Fig. 6.—*Thunbergia natalensis* Hook. × ½

Description.—An erect shrub, 2 ft. or more high, with four-angled stems, which are almost hirsute in specimens grown at Dehra Dun but are stated by Hooker, Bailey and others to be glabrous except at the internodes. Leaves opposite, somewhat crowded, sessile or very shortly petiolate, ovate-acute or acuminate, sinuate-dentate, cordate at the base, palmately 3-nerved, slightly scabrous on both surfaces, glabrous above, hairy on the nerves below, 4 in. long by 2 in. broad. The axillary solitary flowers are seated on peduncles which are shorter than the subtending leaf-blade. Bracteoles at the top of the peduncles herbaceous, 3-nerved, hirsute on the nerves, ovate, spathaceous, nearly as long as the corolla tube, to which it is closely appressed. Calyx bowl-shaped with six blunt teeth. Corolla 2 in. long, shortly conical below swelling above into an infundibuliform curved tube and ending in five obcordate, nearly equal, horizontally spreading lobes. Stamens four; filaments nearly equal, filiform, thickened towards the base; connective bluntly apiculate, anther cells shortly spurred and bearded below. Ovary seated in



oto by *M. N. Bakshi*

Thunbergia erecta (Benth.) T. And.
New Forest, Dehra Dun.

a fleshy disk. Style as long as the corolla tube, obconic, supporting a concave stigma, glandular-hairy and bearded below the stigma. Capsule 1.25 in. long, densely hairy or glabrous.

Flowers.—April-May. Does not fruit in Dehra.

Distribution.—Native of Natal; but now cultivated in gardens throughout India.

Gardening.—An undershrub up to 2 ft. high with handsome pale blue flowers; the corolla tube yellow, 2 in. long. Propagated by cuttings.

Thunbergia grandiflora Roxb.

(*grandiflora* means large-flowered in Latin).

Description.—A large woody climber reaching a height of 20 feet or more. Shoots four-angled or -ribbed, shortly hairy, rough, becoming smoother and glabrous with age. Leaves opposite on the swollen nodes, petiolate, (petioles up to half the length of the blade, twisted at the base and scabrid) cordate at the base, palmately 7-nerved, coarsely toothed or lobed, 4 in. long by 3-4 in. broad, ovate-acute or ovate-acuminate in shape, very rough on both surfaces. Flowers sometimes solitary in the axils of ordinary leaves, but more often, appearing as terminal pendulous racemes, pedunculate (penduncles up to 2 in. long). At the top of the peduncle will be found two velvety, obliquely obovate or oblong bracteoles which are persistent. The calyx is reduced to a velvety rim. Corolla tube shortly conical at the base, then very widely and obliquely campanulate, up to 2.5 in. long, ending in five lobes, the upper two of which are erect and the others spreading. The upper surface of the corolla tube is grooved to take the stamens and style. Corolla whitish in the lower half shading into the blue lobes; yellow inside with blue stripes in the throat. Stamens subequal; filaments about 0.4 in. long, flattened and corrugated at the base where they almost occlude the entrance to the lower conical portion of the tube. Anthers of the lower stamens 0.3 in. long, both cells spurred; those of the upper 0.4 in. long with only one cell spurred; margins densely fringed with long thin hairs. Style 1 in. long; upper lip of the stigma folded and erect, the lower spreading. Capsule shaped like a bird's head 1-2 in. long.

Flowers.—March-November. Fruits cold season.

Distribution.—Native of Eastern Bengal. Commonly grown in gardens in the plains throughout the country.

Gardening.—A very extensive climber with pendent branches, and dark, green, heart-shaped leaves. It bears large bluish flowers from March right through the rains. It is of a very luxuriant growth, and if allowed to climb a lofty tree will cover it with a dense green curtain of foliage. It can, however, be made to flower when small, by judicious close pruning. Easily propagated by cuttings or layers during the rains.

Medicinal use.—A decoction of the leaves is said to be used in Malaya for stomach complaints. The leaves are used as a poultice,

Thunbergia laurifolia Lindl.

(*laurifolius* means having leaves like a laurel).

Fig. 7.—*Thunbergia laurifolia* Lindl. $\times \frac{3}{4}$.

Description.—A shrubby climber with terete, smooth and glabrous stems. Leaves opposite, petiolate, oblong-lanceolate, acuminate, rounded at the base, glabrous and smooth or slightly rough on both surfaces, palmately 3-nerved at the base, reticulation prominent below, up to 7 in. long, 2 in. broad; margins entire or distantly toothed; petioles up to 3 in. long, thickened at the apex and base. Inflorescence in pendulous axillary or terminal racemes. Individual flowers pedicellate. Bracteoles spathaceous, cohering along the upper margin, herbaceous. Calyx very small, cup-shaped; margin crenulate. Corolla tube cylindrical or broadly conical at the base, swelling above, obliquely funnel-shaped, very wide at the mouth. Lobes five, rotundate, emarginate, spreading. Stamens four, inserted near the base of the tube; filaments broad subulate curved. Anthers oblong, apiculate with two subulate spurs at the base; margins fringed. Ovary globose, sunk in the crenately-margined, fleshy disk. Style long, included; stigma two-lobed; lobes channelled.

Flowers and Fruits.—Cold season.

oto by *M. N. Bakshi*

Thunbergia grandiflora Roxb.
New Forest, Dehra Dun.

Distribution.—Upper and Lower Burma, Andamans and the Malay Peninsula, now common in gardens throughout the country.

Gardening.—A large climber which bears during the cold season large lavender-blue flowers in profusion. It is suitable for growing over walls or strong trellis work. Yields seeds abundantly. Propagated by seed or layers.

Medicinal use.—In Malaya the juice of the leaves is said to be efficacious in cases of menorrhagea. It is also applied to the ears for deafness.

Thunbergia mysorensis T. Anderson.

(*mysorensis* refers to the home of the plant).

Fig. 8.—*Thunbergia mysorensis* T. Anderson $\times \frac{1}{2}$.

Description.—A glabrous twining shrub with slender glabrous, often twisted, stems. Leaves opposite, ovate-lanceolate or narrowly elliptic-acuminate in shape, 4-6 in. long by 1.25-2 in. broad, broadly cuneate at the base, sinuate, entire or toothed on the margins; basal nerves 3, prominent with conspicuous venation between; petioles .5-1.5 in. long. Flowers large, in long pendulous interrupted racemes. Bracteoles spathaceous enclosing the corolla tube, ovate-oblong, 1 in. long, parallel-nerved, margins cohering in the bud. Calyx very shallow, salver-shaped; margins obscurely lobed or crenulate. Corolla tube purple, 2 in. long, shortly conical below, swelling above and ending in four lobes, the upper lobe erect with reflexed side lobes, the lower lip of 3 subequal spreading lobes. Lobes bright yellow or maroon, spotted with yellow or brown. Stamens four; filaments hairy at the base; anthers bearded with

a short spur at the base of each cell. Ovary immersed in the thick fleshy disk; style long; stigma cup-shaped. Capsule 1.25 in. long, glabrous, seeds rugose.

Flowers.—Cold season. Seldom fruits in Dehra Dun.

Distribution.—South India in the Western Ghats, South Canara and Mysore to Travancore and Tinnevelly up to 3,000 ft. Cultivated in the plains throughout India.

Gardening.—An extensive glabrous climber with long slender branches; flowers in long pendent racemes bright yellow or orange, or maroon with a purplish tube. Usually shy of seeding and has to be propagated by layering.

Thunbergia coccinea Wall.

(*coccineus* is a Latin word meaning scarlet-coloured, and refers to the bright scarlet flowers of this species).

Fig. 9.—*Thunbergia coccinea* Wall. $\times \frac{3}{4}$.

Description.—A slender climbing and widely spreading twiner. Stems and shoots 4-angled, the angles shortly winged, smooth

and glabrous. Leaves opposite, shortly petioled (petiole twisted), cordate at the base, ovate-lanceolate or ovate, acuminate, the lower variously toothed, the upper entire on the margin, undulate, palmately 5-nerved, smooth and glabrous, green above, somewhat glaucous beneath, up to 5 in. long, 3 in. broad; nerves prominent on the lower surface.

Flowers in terminal or axillary pendulous racemes, up to 3 feet long. Individual flowers shortly or long-pedicelled. Bracteoles 0.5-0.75 in. long, large, spathaceous, cohering along the margins, concave, ovate-acuminate in shape, including the whole flower except the lobes which are reflexed back over them, brown in colour. Calyx bowl-shaped surmounted by 10 or more blunt triangular teeth. Corolla tube infundibuliform, orange in the throat, enclosed in the bracteoles, 5-lobed, emarginate, scarlet, lobes being reflexed over the exterior margins of the spathe. Stamens four, in pairs, the filament dilated at the base; anther cells spurred, the lower with two spurs, the upper with one only. Ovary seated in a disk. Capsule globular; beak short, blunt.

Flowers.—December-March. Fruits March-April.

Distribution.—Outer Himalayas from Kumaon eastwards, Khasia hills, Tenasserim, commonly cultivated in gardens throughout India.

Gardening.—A widely spreading climber with long pendent branches. It bears during the cold weather scarlet or orange flowers in lax pendulous racemes about a foot or more in length. Usually multiplied by layers during the rains.

Part IX.

(*With 1 coloured and 4 black and white plates and 3 text-figures*).

Sophora Linn.

(The generic name is derived from the Arabic name, Sophera, for *Cassia sophera* Linn.).

Sophora belongs to the sweet-pea family (Papilionaceae) which is so well known as to obviate the necessity of a description. The genus itself comprises trees and shrubs with alternate, stipulate, odd-pinnate leaves. The flowers are arranged in racemes or panicles and are yellow or violet-purple in colour. The calyx is gamosepalous, oblique, broadly campanulate in shape, surmounted at the top by short, deltoid teeth. The corolla consists of five clawed petals. The upper petal is broad, erect and is termed the standard or vexillum; the two side petals are narrower and are called the wings or alae; the 2 lower petals loosely connate by their lower margins are the narrowest and form the so-called keel or carina. The stamens are 10 in number, free or obscurely joined at the very base; the anthers are versatile. The ovary is shortly stalked, with many ovules on the ventral suture. The pod is constricted between the seeds and is termed moniliform, that is, somewhat like the beads on a necklace.

The species of this genus are valued for their pretty often fragrant flowers, and for their handsome foliage and curious pods. They are inhabitants of the warmer countries of the world but mainly at high altitudes, and therefore some of them have been introduced with success into Europe. *Sophora japonica* L. was introduced into France by Jussieu in 1747, and is common in that country and in Germany. It has been found that it is capable of withstanding the smoke-vitiated atmosphere of towns especially in the neighbourhood of railway stations.

The brightly coloured and fragrant flowers indicate that these plants are cross-pollinated through the agency of insects.

As has already been said the leaves of *Sophora* are odd-pinnate, that is, they are composed of an odd number of leaflets arranged on either side of a central rhachis. The leaflets can be distinguished from ordinary leaves by the fact that they do not possess a bud in the axil of the stalklet or pulvinus. During the night some of these species arrange their leaves in the sleep-position. Towards nightfall the pulvini move and the leaves drop downwards and their under surfaces are pressed together. This is one of the ways in which a plant avoids loss of heat and water through excessive transpiration.

Several Sophoras are well known for their poisonous properties. This is due to the presence of an alkaloid which is variously known as sophorine or cytisine. It is a very dangerous drug causing convulsions and death. The seeds and roots of *Sophora tomentosa* Linn. contain cytisine, and are used as remedies in small doses for cholera and diarrhoea.

SOPHORA TOMENTOSA Linn.
(nat. Size.)

The unopened flower buds and pods of several species give a yellow dye; when used in conjunction with the indigo plant (*Indigofera flaccidifolius*) the resultant colour is green. In Baden, Germany, the unopened flower buds are used to colour Easter eggs. In Japan this yellow dye is said to be used exclusively to dye the garments of the Royal House.

The wood being extremely hard is of use in joinery and parquetry.

KEY TO THE SPECIES.

Flowers yellow.

Leaflets up to .5 in. long ... ... *S. Griffithii.*
Leaflets 1 in. long or over ... ... *S. tomentosa.*

Flowers blue to violet.

Leaflets leathery, over 1 in. long ... ... *S. secundiflora.*
Leaflets soft, up to .5 in. long ... ... *S. viciifolia.*

Sophora Griffithii Stocks

(The specific epithet commemorates the name of William Griffith (1811-1845) one of that noble band who did so much for Indian Botany in the early nineteenth century).

Description.—A small, erect deciduous shrub. Young twigs densely hoary. Stipules minute, villous, often persistent after the fall of the rhachis. Leaves alternate, compound, odd-pinnate, 4-8 in. long. Leaflets 21-41, opposite or alternate, .25-.5 in. long, ovate, oblong or obovate in shape, thick, rigid, glabrous above when mature, densely appressed silvery-velvety beneath.

Fig. 1.—*Sophora Griffithii* Stocks. $\times \frac{1}{2}$.

Inflorescence of pedunculate racemes from old leaf scars, 1.5-5 in. long; peduncle usually leaf-bearing. Flowers .7 in. long, yellow, appearing with the young leaves; pedicels silvery hoary, .1-.2 in. long, in the axils of hoary buds. Calyx gamosepalous, very oblique, .2 in. long, densely appressed hoary, ending in 5 shorter triangular teeth. Petals 5, yellow; standard longer than the keel, markedly veined, almost orbicular in shape, emarginate at the top, ending below in a long strap-shaped claw; wings obliquely oblong-obtuse, clawed below, toothed on either side above the claw; keel of two petals loosely connate along the lower margins, upper margin toothed above the claw. Stamens ten; filaments free to the base.

Ovary hirsute with appressed white hairs; style slender, incurved; stigma capitate. Pod up to 4 in. long, with four winged ridges, constricted between the ellipsoid seeds, hairy.

Flowers.—March-April. Fruits hot season.

Distribution.—Salt Range and trans-Indus hills, Baluchistan, Afghanistan and Persia. Occasionally cultivated in gardens in India.

Gardening.—A small shrub with velvety, silvery grey leaves and large bright yellow flowers appearing shortly before or with the leaves. Usually propagated by seed.

Sophora tomentosa Linn.

(*tomentosus* means hairy in Latin).

Description.—A large shrub or small tree, the whole plant being covered with a soft grey-velvety pubescence. Leaves alternate, odd-pinnate, 6-10 in. long, with 15-19 leaflets; rhachis terete, tumid at the base; leaflets often alternate on the rhachis, shortly stalked, 1-1.5 in. long, broadly elliptic in shape, rounded or obtuse at both ends, dull grey-green in colour, thinly downy above, the lower surface covered with a dense pubescence; margins somewhat reflexed.

Inflorescence a terminal raceme up to 6 in. long. Individual flowers pedicellate, often crowded; pedicels densely silky, bracteate, .25-.3 in. long, jointed just below the calyx. Calyx tube broadly campanulate, almost truncate with 5 very small obscure lobes, minutely silky, oblique, .25-.4 in. long. Corolla yellow, of 5 petals. Standard long clawed, .6-.75 in long; blade orbicular or elliptic, slightly emarginate. Wings oblong-obtuse, narrow, clawed. Keels of two narrow, clawed petals. Stamens 10; filaments free to the base or nearly so. Ovary shortly stalked, linear, tapering at the apex, densely hairy; style straight; stigma capitate. Pod long-stalked, issuing from the persistent calyx, moniliform, the joints being separated by narrow necks as long as themselves, pointed, covered with a brown velvety down; seeds 1-8 in each pod, .35 in. in diameter, nearly globular, pale brown.

Flowers.—Rainy season with a second flush in the cold weather. Fruits cold season.

Distribution.—Cosmopolitan in the tropics on the sea coast. Widely cultivated in gardens throughout the plains of India.

Gardening.—The shining, dark green, handsome foliage of this shrub contrasting with its bright yellow flowers, render it a very ornamental plant. Unfortunately in Dehra it is liable to be infested by a caterpillar which at times strips it of all its leaves and beauty. Easily raised from seed during the rains. It is apt to be damaged by frost in northern India.

Medicinal and Economical uses.—The seeds and roots of this plant contain the alkaloid cytisine and are considered medicinal in Malaya. Small doses of it are used as remedies in cases of cholera and diarrhoea. According to Heyne pounded leaves are applied on wounds caused by certain poisonous fish.

Burkill says that the timber is hard and heavy, but is not much used.

P.'o by M. N. Bakshi

Sophora griffithii Stocks
New Forest, Dehra Dun.

Photo by *M. N. Baki*

Sophora griffithii Stocks
New Forest, Dehra Dun.

Photo by M. N. Bakshi

Sophora tomentosa Linn.
New Forest, Dehra Dun.

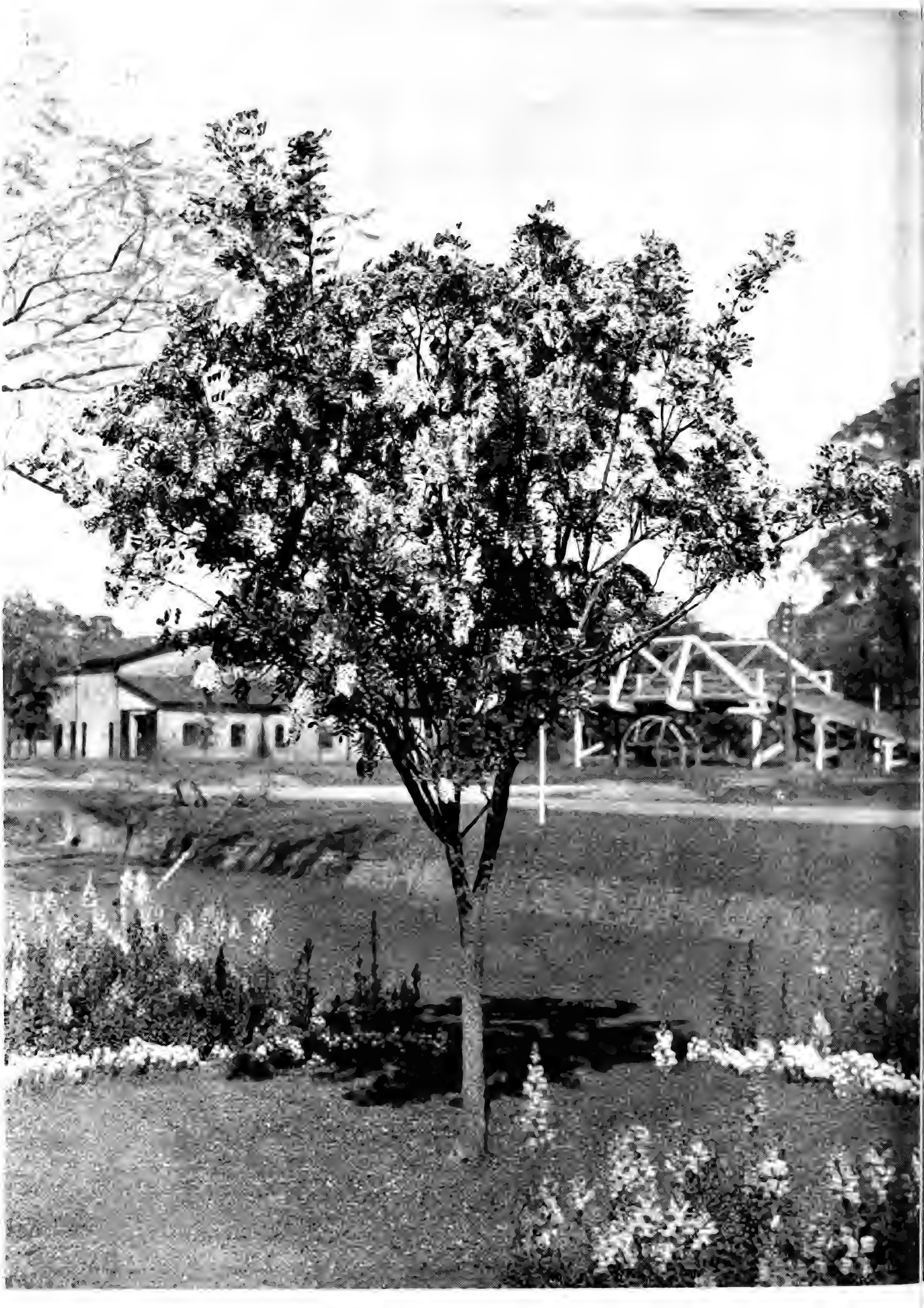


Photo by *M. N. Bam*

Sophora secundiflora DC.
New Forest, Dehra Dun.

Sophora secundiflora Dc.

(*secundiflora* is a Latin word meaning flowering to one side, from the fact that the flowers are arranged in one-sided racemes).

Fig. 2.—*Sophora secundiflora* Dc. $\times \frac{1}{2}$.

Description.—An evergreen shrub or a small tree, which may reach 35 ft. in height, with smooth bark and young shoots covered with an appressed silvery pubescence. Buds ovoid, densely covered with short hairs. Leaves compound, alternate, odd-pinnate, 4-6 in. long, with 7-9 leaflets; rhachis glabrous or hairy, grooved on the upper surface; leaflets opposite, dark green and shining, rather leathery, evergreen, oblanceolate or obovate in shape, with swollen pulvini, 1.25 in. long, emarginate at the apex; nervation reticulate, very prominent below.

Inflorescence of one-sided, terminal racemes, 2-3 in. long. Individual flowers very fragrant, about, 1 in. long, pedicelled; pedicels .3 in. long, supported by a bract and bearing two small bracteoles halfway up, covered with silvery, appressed pubescence. Calyx gamosepalous, .3 in. long, including the lobes, brown in colour, covered with appressed pubescence, lobes 5, the upper broadly obtuse, the lower four deltoid in shape. Petals five; standard oblong, .5 in. long, .5 in. wide, cordate at the apex, contracted into a strap-shaped claw below; wings and keel obliquely oblong, rounded at the tip, sagittate at the base, with a strap-shaped claw. The petals

are violet-blue or pale blue in colour, and the standard has a few darker spots near the base. Stamens 10, equal; filaments slightly connate at the base, inserted on the hypanthium. Ovary narrowly elliptic-oblong, stipitate, covered with coarse hairs, .3 in. long; style slender, curved, glabrous; stigma small, capitate. Pod 1-7 in. long, .5-.75 in. in diameter covered with white hairs, constricted between the seeds. Seeds bright scarlet.

Flowers.—March-April. Fruits rainy season.

Distribution.—Indigenous to the Southern United States and North Mexico; now frequently cultivated in gardens throughout the plains of India.

Gardening.—A shrub or a small tree with short slender trunk and upright branches forming a narrow head. Flowers fragrant, handsome, violet-blue. It is a very free flowering and ornamental plant but its growth is slow. Raised from seed sown during the rains.

Medicinal and economic uses.—The seeds of this species are poisonous due to the presence of the alkaloid cytisine or sophorine. This alkaloid if taken in big doses causes nausea, then convulsions and finally death by asphyxia.

Sophora viciifolia Hance

(*viciifolius* expresses in Latin the similarity of the leaves of this species to those of Vicia (the Vetch), another genus of the family).

Fig. 3.—*Sophora viciifolia* Hance $\times \frac{1}{2}$.

Description.—A small shrub reaching 6 ft. in height with striate stems. Lateral branches covered with short white hairs, often

arrested and then appearing as spines. Stipules spinescent. Leaves alternate, compound, odd-pinnate, up to 2 in. long; rhachis cylindrical, covered with short appressed silvery pubescence; leaflets 11-15, almost sessile, .25-.5 in. long, oblong or elliptic, obtuse, mucronulate, glabrous above, covered with white pubescence beneath; nervation, apart from the mid-rib, obscure.

Inflorescence of short axillary or terminal 6-12-flowered racemes. Individual flowers seated on hairy pedicels .3 in. long, bluish violet or nearly white in colour. Calyx gamosepalous, violet in colour, membranous, shortly 5-toothed, cylindrical in shape, somewhat oblique, covered with appressed pubescence. Petals 5; standard spathulate-obovate, reflexed, clawed; wings oblong-obtuse, with a tooth on one side; keel-petals clawed, oblique. Stamens 10; filaments free or slightly connate at the base. Ovary stipitate, oblong, pointed at both ends, covered with coarse hairs; style curved, glabrous, slender; stigma capitate, small. Pod 2 in. long, slender, long-beaked.

Flowers.—March-April. Has so far not fruited in Dehra.

Distribution.—Indigenous to Central and Western China, now cultivated in various parts of India.

Gardening.—The violet calyx makes an attractive contrast to the milky white corolla of this hardy graceful shrub. It was introduced into the Royal Gardens, Kew, in 1898, where it flowered for the first time in July 1902. Easily grown from seed.

(To be continued)

THE BIRDS OF BAHĀWALPŪR (PUNJĀB)

BY

SÁLIM ALI.

(*With a map and 4 plates*).

Thanks to facilities afforded by H. H. The Nawab's Government it became possible to undertake the much-desired survey of the bird life of Bahāwalpūr State in the early part of 1939. During the period from 27 January to 24 March 331 specimens, representing some 115 forms, were collected in addition to a considerable amount of field notes and ecological data. Unfortunately the time was far too short for any but the most superficial study of some of the problems peculiar to desert conditions; the aim of this paper is mainly to place on record the present position of the avifauna so as to provide a basis for comparison at some future date when irrigation and colonisation will have altered the face of the country still further.

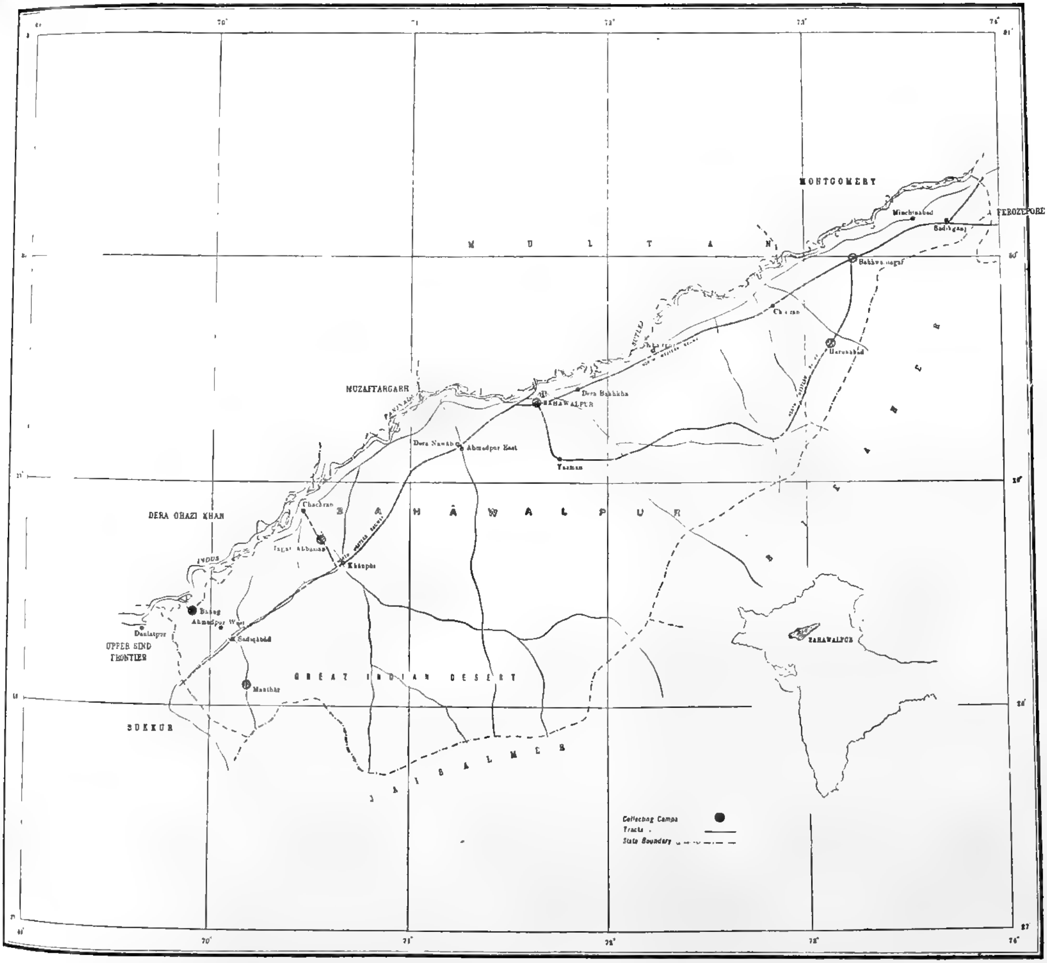
Bahāwalpūr State in its present phase is a particularly promising venue for the study of plant and animal successions since, like other similar canal-irrigated tracts in the Punjāb and Sind, it is undergoing a process of profound physical changes, before our eyes as it were. The vast system of irrigation canals originating in the Sutlej River, which has been completed and brought into operation within the last 30 years, is responsible for this magical transformation. Arid, sun-scorched sandy wastes, broken only by a dreary succession of shifting sand-dunes and dotted with a sparse and scanty growth of desert plants, are being rapidly converted into a prosperous, green and intensively cultivated region punctuated by large leafy Banyan, Peepal, Neem and other trees sheltering the newly sprung homesteads of the colonists, and by thriving forest plantations of Shisham trees (*Dalbergia Sissoo*).

I must again record my thanks to Mr. Hugh Whistler for the precise determination of the material collected and for his useful taxonomical notes (in square brackets) thereon. Also for his many helpful suggestions from time to time before, during and after the work in the field. For we were then still at that happy period of our civilisation, now alas in total eclipse, when aeroplanes did not mainly signify bombers or fighters, but were the means of that speedy and peaceful concourse between the ends of the earth which enabled our close and constant collaboration in dealing with various problems as they arose in the field.

PHYSIOGRAPHY.

Bahāwalpūr State, covering an area of 15,918 square miles, lies in the extreme south-west of the Punjāb between 27° 42′ and 30° 25′ N. and 69° 31′ and 74° 1′ E. Its northern boundary runs along the Sutlej, Chenāb and Indus rivers. In the south-west the Sukkur District of Sind abuts on to it, while south and south-east

Journ.



MAP OF BAHAWALPUR STATE

Scale approx. 1″=32 miles.

it is bordered by the Rājpūtāna desert States of Jaisalmēr and Bikanēr. The greatest length of the area from N.-E. to S.-W. is about 300 miles, the mean breadth being about 40.

Devoid of hills and streams except the pools and backwaters of the great rivers on its northern boundary, e.g. the duck-shooting *dhands* at Jajjāh-Abbāsiān, the State is divided lengthwise into three great strips. Of these the first—the southernmost and broadest—is a slice of the Great Indian Desert, largely with rolling sand-dunes and known as Rōhi or Chōlistān. It is separated from the adjacent tract by a depression known as the Hakra, the ancient bed of some bygone river and variously ascribed to the Sutlej, the Ghaggar and the Jumna.

The central tract is chiefly flat desert or *pat* country a large portion of which has recently been brought under cultivation by means of canals. The third is a fertile, irrigated, narrow, alluvial tract in the river valley, called the 'Sind'. In the ecological notes that follow these three tracts will be referred to as I, II and III respectively.

The elaborate network of irrigation canals and the colonisation of erstwhile wastelands, is tending more and more to alter the character of the landscape and to obscure the demarcation between these three longitudinal belts. The central belt and the riverain are fast losing—or have already lost in many parts—their distinctive characters and are often difficult to distinguish. The canals have not stopped at the central belt, but in many sectors have made considerable inroads into the Chōlistān itself, thus depriving large areas of their truly desert character. But the desert still holds sway over much of its pristine domain and any vast change in the hinterland is unlikely, at least for a considerable time.

The climate is characterized by excessive drought. Rainfall is scanty and irregular, the annual precipitation for the State as a whole rarely exceeding 5″. Most of this falls during the S.-W. monsoon season, but some also in winter. From April to the middle or end of June the mean shade temperature is 103°F. The air is dry and the wind scorching, so that the growth of vegetation is imperceptible. But with only 1″ of rain a miraculous transformation takes place and the country becomes fresh and green. After November the mean temperature falls to 60° or 65°F with frosty nights.

Vegetation corresponds with the physical aspects of the three divisions. The scenery of the fertile riverain with its countless date palms especially lining the inundation canals, is almost Egyptian or Mesopotamian in character. A belt of tamarisk jungle stretches for miles along the river. In the other two tracts (II and I) wherever irrigation canals have not altered the aspect, sparse desert scrub—characteristic of so much of the Punjāb and Sind—holds sway. Most prominent among the species here met with are the Kandi (*Prosopis spicigera*), the Ak (*Calotropis gigantea*), the Wild Caper (*Capparis aphylla*), *Salvadora oleoides*, the Lāni and Lāna (species of *Salsola*), and *Suaeda* spp. In Chōlistān there are, moreover, stretches of Khar (*Haloxylon Griffithii*).

The desert areas worked by the survey are mainly (1) Yazmān (20 miles south of Bahāwalpūr town), (2) Manthār (14 miles south

of Ahmadpūr Lamma) and (3) Hārūnābād (at the eastern end of the State). Of these three localities more or less pure desert conditions now prevail only at Yazmān. In the proximity of the newly introduced canals there are scanty fields of sirsūn (mustard), wheat and gram. Immediately beyond stretches a succession of sand-dunes with their typical shrubs, interspersed with extensive *pats* of firm level ground. The sand-dunes in places are hard crusted, but for the most part they consist of loose, rippled, wind-blown sand. Amongst the scanty xerophytic vegetation, the two species of *Salsola,* locally known as Lāni and Lāna, predominate.

Manthār, while in general retaining its typically desert character, represents a further stage in the evolution of the canal colonies. The desert is here encroached upon to a greater extent than at Yazmān since this area was canalised and opened up to cultivation some years earlier. The soil has, however, proved to be poor and subject to water-logging, and large patches are *kallar* and covered with a deposit of salt. The usual desert shrubs are in evidence around the 'island' of cultivation and on and about the abandoned crusty-surfaced fallow land. Beyond succeeds an infinity of sand-dune wastes.

Hārūnābād is what may be termed the climax of canal-irrigated desert cultivation in Bahāwalpūr State. Pure desert until a few years ago, it is at the present time an extensive, fertile, green and intensively cultivated tract. Striking development has taken place within the last twelve years during which has sprung up the flourishing town of Hārūnābād with a large and important *mandi* or grain market. Shīsham (*Dalbergia Sissoo*) and Babūl (*Acacia arabica*) trees of respectable size lining the canal banks, dotted about the cultivation or growing in well-tended forest plantations, impart to the country a refreshingly green and wooded appearance. The numerous minor water channels that intersect the area are lined on both banks with Ak (*Calotropis gigantea*) and clumps of the tall coarse *Sar* grass (*Saccharum*). Beyond the island of cultivation and with incongruous suddenness comes the desert—an undisturbed succession of hummocky sand-dunes with *pats* interspersed, as if in constant watchfulness, ready to sweep in and reclaim lost territory should the vigilance and industry of Man show the least relaxation.

Desert Colouration.

A great deal has been written concerning the 'effacing' colouration of desert animals. The various problems in this connection were constantly borne in mind but although a quantity of factual and suggestive data was obtained, no nearer approach to a solution of any of them can be claimed. The investigator in the desert is early beset by curious anomalies, but the general truth is sufficiently obvious that the majority of animals here are in fact coloured strikingly like the soil upon which they live. He is naturally led to the conclusion that this close colour resemblance, by rendering the animal inconspicuous in its environment, gives it a degree of protection from its enemies, or if a predator it confers advantage in capturing its prey. A little observation, however,

soon convinces him that for the colouration to achieve this end effectively one vital condition *must* be fulfilled, and that condition is complete immobility. Movement at once betrays an animal howsoever obliteratingly coloured. One variety of *pat* commonly met with in the desert, is pinkish and of a hue strikingly like that seen in the wings and tail of the Desert Finch-Lark (*Ammomanes deserti*). I frequently observed that a scattered group of 3 or 4 of these birds feeding on such soil only a few yards away could become completely obliterated from view. But the effacement lasted only up till such time as the birds remained perfectly motionless. The slightest movement on their part sufficed to dispel all illusion of their invisibility.

It is a well-known habit of birds frequenting bare open spaces—like bustard and stone-curlew—to squat down and stretch out their necks, lying 'doggo' on the approach of an enemy as if conscious of their natural camouflage. But under normal conditions it must be only rarely that they receive sufficient warning of impending danger to enable them to resort successfully to this ruse. In nine cases out of ten the predator's attention has, in the first instance, been drawn to its quarry by its movements while in search of food. In such cases it is difficult to believe that obliterating colouration even helped by such a manoeuvre can and does give them adequate protection.

There seems no doubt, however, that effacing or obliterative colouration *may* (and in fact does) at times serve to protect an animal from a *chance* predator. For example, no seed- or fruit-eating bird will fail to seize a juicy insect or spider if accidentally come upon. But if that insect or spider happens to be effacingly or unobtrusively coloured—and what is still more important, if it remains motionless—it may stand a fair chance of being passed by. Not so, however, from an insectivorous bird that *habitually* preys upon such quarry. In that case the colouration alone will not save its possessor. In other words it seems unreasonable to suppose that effacing colouration by itself can give adequate protection to an animal against a predator who has been habituated and trained from infancy to hunt effacingly coloured prey, often to the exclusion of other prey not so coloured.

Apart from other considerations it is by no means certain that the faculty of colour-perception in animals is sufficiently developed for them to differentiate so keenly between colours, and even between shades of the same colour, as to have evolved through Natural Selection—as some still hold—the remarkable similarity in the colouration of desert animals to their sandy environment. Experiments suggest that a bird's vision and man's are practically the same towards the orange-yellow end of the spectrum (long-wave lengths), but that birds cannot perceive blues and violets at all. Colour sense in mammals seems to be considerably poorer. A dog, for example, is said to see objects only in monotones, something like a sepia-toned photograph, and the proverbial red rag to a bull probably means no more than a rag of any other dark colour. This being the case it seems futile to speculate on the true merits of what we call the effacing colouration of a desert animal to its possessor.

Whatever the benefits derived from desert colouration by its possessors, to my mind at least it appears highly improbable that the presence of such colouration is the direct result of Natural Selection, i.e. that it came about by the gradual elimination of such organisms as did not conform with the colouration of their sandy environment. It seems more reasonable to suppose that the same factors as are responsible for making the desert desert-coloured are also responsible for making the majority of its animals, both diurnal and nocturnal, desert-coloured: that the similarity is thus primarily the result of some purely mechanical and extraneous process or processes. That humidity has something to do with it, and may even be the principal controlling factor, seems clearly established. Animal forms living in moist evergreen forest biotope are invariably darker pigmented than their representatives inhabiting a more arid environment. Animals are palest coloured in the desert where humidity is lowest, and darkest coloured in areas where it is highest.

An attractive theory, that has stood the empirical test, is advanced by Col. R. Meinertzhagen (*Ibis*, 1940, p. 120). This authority who has had considerable experience of deserts in Africa and Asia and has made a special study of desert birds and life conditions, suggests that the density of humidity (ozone?) in the atmosphere controls the amount of ultra-violet radiation that gets through to the earth and therefore to the life upon the earth. In the very low humidity of the desert a very high percentage of the ultra-violet rays get through, whereas in heavily saturated air their penetration is greatly impeded. According to him wherever a large amount of ultra-violet radiation gets through one finds comparatively lightly pigmented plumage or fur among the resident animals, and wherever the radiation is obstructed and reduced by atmospheric humidity comparatively darkly pigmented plumage or fur is met. In a discussion on the relation between plumage and environment (*Ibis*, 1934, p. 54) Meinertzhagen pointed out that in the Red Sea littoral which enjoys brighter sunshine than Sinai, Egypt or Palestine and where rain is practically unknown, is found the darkest form of the Sand-Partridge (*Ammoperdix hayi cholmleyi*). This seeming anomaly is explained by the fact that the humidity in this region is double in density to that of the Sahara and much greater than that of Sinai, Egypt or Palestine in all of which countries paler forms of this partridge occur. In spite of the cloudless dazzling skies of the Red Sea littoral, the suspended water vapour in the air reduces the force and effect of the ultra-violet rays getting through to the earth and brings about the same darkening of the plumage of birds as it does in humid forested regions.

A suggestive fact noted by me in the course of the Bahāwalpūr Survey was how after being drenched in a shower of rain the colouration of desert birds, e.g. *Ammomanes deserti* and *Cursorius cursor*, darkened to exactly the same shade of brown as that of the sodden soil upon which they found themselves. These very birds whose pale sandy colouration was of some obliterative value to them in an environment of pale dry desert sand now enjoyed the same advantage when the soil was rain-sodden and rendered considerably darker. Here is a suggestion that it may in reality be

Fig. 1.—Tamarisk and kandi (*Prosopis*) scrub on flood-inundated land, as in Tracts II and III. (Haunts of *Dryobates scindiánus, Molpastes leucogenys Cyanosylvia swecica, Phoenicurus ochruros* and several *Phylloscopus*).

Photos : *the late F. H. Hallberg.*

Fig. 2.—An aspect of the desert in Tract II-I.

Fig. 1.—An aspect of the desert as in Tract I—Hārūnābād environs.

Photos : *the late F. H. Hallberg.*

Fig. 2.—Cultivation in desert canal colony interspersed with sand-dunes, as about Yazmān and Manthār (Tract I). (Haunts of *Chamydotis u. macqueeni, Sylvia curruca* and *nana, Œnanthe xanthoprymna, Œ. capistrata, Argya caudata* etc.).

the same common factor (or set of factors) that is directly responsible for the similarity in the colouration of desert animals and of their environment. In this case that common factor was moisture.

I had also frequent occasion to remark how the slanting evening sun, shortly before set, imparted to the desert the same pinkish or vinaceous flush as is to be seen in the plumages of such desert birds as *Ammomanes deserti, Lanius phoenicuroides* and *L. minor.* This may only be a coincidence, but the similarity is such that no observant person can fail to be struck with it.

Itinerary.

27 January-11 February; 8-11 March: Bahāwalpūr Town & Environs (III)
12-19 February: Bhūng (III)
20-27 February: Manthār (I)
28 February-7 March: Jajjah-Abbāsiān (III)
12-17 March: Hārūnābād (I-II)
18-24 March: Bahāwalnagar (III)

In the course of the Survey over 1000 miles were covered by motor car within the State, and every type of country visited. Public roads as such are few in number and poor in quality, but the excellent roads maintained by the Irrigation Department, running along the canal bunds throughout the vast network that now spreads over all but the remotest desert tracts, are open to private motor traffic. They afford a speedy and fruitful access to distantly outlying localities, to explore which it would otherwise necessitate tedious days on camel back and elaborate camping arrangements. Thus collected, the specimens are naturally representative of a much wider area than indicated by their labels. For convenience in placing the localities on ordinary maps, obscure place-names have been avoided and those of better known landmarks nearby substituted in their stead.

During the limited time at the disposal of the Survey it was naturally impossible to determine the correct status of the various species met with, i.e. whether a species is a winter, summer or rains visitor, and whether it breeds in the locality or not. In many cases, as with most of the wildfowl, the status is of course well-known, but the deficiency remains where resident birds and local migrants are concerned. In the notes that follow, therefore, it must be understood that such remarks as 'Common', 'Occasional' and others, apply only to the period covered by the Survey.

SYSTEMATIC LIST[1].

Corvus corax laurencei Hume. The Raven.

Specimens collected: 39♂, 40♀ 2-2-39 Bahāwalpūr Town environs (II-III). Elsewhere noted: Yazmān, Manthār, Hārūnābād (I).

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[1] I = Desert (Chōlistān or Rōhi); II = Semi-desert (central belt); III = Riverain tract (the Sind).

[Measurements :

	Bill	Wing	Tail
1 ♂ ad.	78	448	242 mm.
1 ♀ ad.	74	413	220 mm.—H. W.]

Fairly common in small numbers. Usually pairs, but sometimes small parties of 4 or 5 (once 15) about colonists' homesteads in the canal-cultivated desert areas (I and II). Has a bell-like call which in the distance sounds rather like bits of a Barred Owlet's (*Glaucidium*).

Some of the birds on the outskirts of Hārūnābād town—where they largely fed on offal—were evidently *ruficollis*.

The survey specimens were sexually mature and apparently breeding. Testes 22×15 ; largest ovarian follicle 5 mm.

Corvus splendens zugmayeri Laub. The Sind House-Crow.

Specimens collected : 146♂, 147♀ 18-2-39 Bhūng (II-III).
Elsewhere noted : Hārūnābād town (I) ; Bahāwalpūr town and environs, Bahāwalnagar town and environs (III).

[Measurements :

	Bill	Wing	Tail
1 ♂ ad.	52	264	163.5 mm.
1 ♀ imm.	44	243	149 mm. —H. W.]

Very common and abundant in towns and villages in III, and also in the fairly well established canal colonies in I as in Hārūnābād and its environs. It has not yet penetrated to the more recent colonies in I, e.g. Yazmān and Manthār, but its extension there is no doubt only a matter of time.

Within the village of Bhūng stand some large Banyan and Peepal trees which are the nightly roost of hundreds upon hundreds of House-Crows. The birds flight in every evening before sunset in straggling parties and flocks over long distances and from all points of the compass. Although there are other large trees in neighbouring villages the crows concentrate only upon this particular grove in Bhūng. This preference is, I think, explainable by the historical fact that Bhūng is the oldest village in the locality. Its trees have been used by the crow population since long before the outlying villages became sufficiently established to provide similar amenities. The Bhūng roosts therefore continue to function as community centres to this day. Another very large roost was seen in a shisham plantation on the outskirts of Bahāwalnagar town. Mangled and partly desiccated remains of several crows, one here another there, were found lying on the ground under the roost trees. Two of these had their heads completely wrenched off. Who was the culprit?

The gonads of the specimens were inactive.

No Jungle Crows were met with in Bahāwalpūr State.

Dendrocitta vagabunda pallida (Blyth). The N.-W. Indian Tree-Pie.

Specimen collected : 83 ♀ 7-2-39. Bahāwalpūr town environs (III).
Elsewhere noted : Bhūng, Jajjah-Abbāsiān, Chāchrān (II-III).

[Measurements :

	Bill	Wing	Tail
1 ♀ ad.	34	162	277 mm. —H. W.]

Not common. The first example seen in Bahāwalpūr town or its environs was only after a whole week's working in the locality, during which I had specifically noted it as absent.

Met with singly or in pairs—occasional—in trees in Inspection Bungalow compounds, well-grown shisham plantations and the like.

On 5 March (Chāchrān) a nest was found 30 ft. up in a Babūl tree in the Inspection Bungalow compound. One of the owners visited it several times and sat in momentarily, but on examination it was empty !

Remiz coronatus (Severtz.). The Penduline Tit.

Specimens collected : 68 o?, 69 ♀ 7-2-39. Bahāwalpūr town environs (III-II); 281 o?, 282 ♀, 283 ♀ 14-3-39. Hārūnābād (I); 303 ♂, 304 ♀ 19-9-39, 320 ♂ 20-3-39. Bahāwalnagar (III-II).
Elsewhere not noted.

[Measurements :

	Bill	Wing	Tail
2 ♂♂	10	52-53·5	43-44 mm.
6 ♀♀	10-11	52-54	39-43·5 mm.

This species had not previously been known to extend into N.-W. India below the line Lahore, Mozaffargarh and Upper Sind about Ruk Junction so its occurrence in some numbers in Bahāwalpūr State is a slight but interesting extension of range.—H. W.]

The Penduline Tit was not uncommon in the localities where the specimens were obtained. It was inseparable from shisham trees (*Dalbergia*) whether planted along the boundary of Inspection Bungalow compounds, along canal banks or in the various plantations of the Forest Department.

Small flocks were met with hunting insects in the foliage of these, especially amongst the freshly sprouting sprigs. They have the typical tit habits of clinging upside down and sideways to the leaf clusters in quest of food. The birds utter mousy cheeping notes as they move about—*swee* . . . *swee* etc.—rather like those of *Dumetia*, but feebler.

Whether the birds here were merely winter visitors or had some other status could not be ascertained.

Turdoides somervillei sindianus (Ticeh.). The Sind Jungle Babbler.

Specimens collected : 128 ♂ 16-2-39 Bhūng (III-II).
Elsewhere noted : Bahāwalpūr town and environs, Jajjah-Abbāsiān, Bahāwalnagar (III-II); Hārūnābād (I).

[Measurements :

	Bill	Wing	Tail
1 ♂	24·5	105	111 mm.

—H. W.]

Patchily and locally distributed. Both in Bhūng and in Rahīmābād—two villages about 3 miles apart isolated from each other by canal cultivation—situated in the midst of semi-desert country, a single flock each of these Jungle Babblers was observed within the small walled-in mango gardens belonging to their respective zamindars. No others were seen, nor did the country around seem a likely habitat.

In other localities the birds frequented tamarisk jungle on the margin of *dhands*, and groves of trees about villages. In shisham plantations with tall coarse grass and thickets the terrain of the Jungle Babbler overlapped that of *Argya earlii*.

At Hārūnābād the species was met with in the wooded Inspection Bungalow compound and in other similarly wooded patches. It has as yet not spread to the younger desert canal colonies of Yazmān and Manthār since the requisite habitat has not developed there.

Argya earlii (Blyth). The Striated Babbler.

Specimen collected : 314 ♂ 19-3-39 Bahāwalnagar (III-II).
Elsewhere not noted.

[Measurements :

	Bill	Wing	Tail
1 ♂	22	95	worn

—H. W.]

Two flocks were observed in a dense patch of tall *sarkan* grass on the edge of a shisham plantation, and a third amongst a bed of bulrushes in a *dhand*. It inhabits better wooded, moister localities than *A. caudata*.

The specimen, with testes enlarged to 16×8 mm., was probably breeding.

Argya caudata caudata (Dumont). The Common Babbler.

Specimens collected: 67 ♂ 6-2-39 Bahāwalpūr town environs (III-II); 136 ♂ 17-2-39 Bhūng (III-II).
Elsewhere noted: Yazmān, Manthār (I); Bahāwalnagar (III-II).

[Measurements:

	Bill	Wing	Tail
2 ♂♂	20.5	81.5-84.5	123-128 mm.

Both these birds have remarkably long tails 123 and 128 mm., the length usually associated with *A.c. eclipes*, but their colour and the identity of other specimens from neighbouring areas in the S.-W. and S.-E. Punjab shows that one is safe in calling them *caudata caudata*. Length of tail is very variable in this species—for instance 2 ♂♂ collected at Dandot 2000′ in the Salt Range within a month of each other, have tails of 113 and 130 mm. and I could quote similar examples in other districts.—H. W.]

Common on the fringe of desert cultivation and on the banks of dry sandy canals in a mixed growth of tall coarse *sarkan* grass and kandi (*Prosopis*) bushes, scuttling about like rats from one clump to another. Also in II about *pats* with *Salvadora* and *Capparis* bushes. Flocks were also met with far out in the desert amongst sparsely scrubbed sand-dunes. In this biotope, along with *Sylvia c. blythii* and *S. minula* it was the commonest bird species to be met.

At Bahāwalnagar the edge of its terrain overlapped the edge of that of *A. earlii* so that frequently both species could be seen side by side in a circumscribed area.

The gonads of No. 136 (17 February) were enlarged to 12×5 mm., and the bird was evidently preparing to breed shortly.

Chrysomma sinensis hypoleucus (Frankl.). The Sind Yellow-eyed Babbler.

Specimens collected: 220 ♀, 221 ♂ 4-3-39 Jajjah-Abbāsiān (III-II); 327 ♂, 328 ♀ 22-3-39 Bahāwalnagar (III-II).
Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
2 ♂♂	14-14.5	67-67.5	95 mm.
2 ♀♀	13-13.5	64.5-67.5	99 mm.—H. W.]

Not common. Frequents date scrub along dry canal banks and tall *sarkan* grass intermingled with thorn thickets, on the edge of young Shisham plantations. Two of the specimens were obtained from a flock which kept to heavy tamarisk scrub standing partially submerged in a *dhand*.

A careful look-out was kept for *Chrysomma altirostris* but without success.

Molpastes leucogenys leucotis (Gould). The White-eared Bulbul.

Specimen collected: 116 ♂ 15-2-39 Bhūng (III-II).
Elsewhere noted: Bahāwalpūr town environs (III); Manthār, Hārūnābād (I).

[Measurements:

	Bill	Wing	Tail
1 ♂	17	87	81 mm.—H. W.]

Fairly common—usually in pairs or small parties—and generally distributed in all three tracts. In I it is found for considerable distances in the interior, but is absent in the most outlying and sandy desert portions. Partial to riverain jungle subjected to annual flood inundation where tamarisk and kandi (*Prosopis*) abound. On one occasion a gathering of over 30 birds was observed feeding on black ants on the ground. In desert and semi-desert areas the fruit of *Capparis* and *Salvadora* form the main attraction for this bulbul.

Molpastes cafer [pallidus (Baker)]. The Central Indian Red-vented Bulbul.

No specimens.

A single example (or pair?) was observed in the garden of the Guest House (Abbās Manzil) on 10-2-39. Escaped cage bird?

Certhia himalayana limes. The Tree-Creeper.

Specimens collected: 81 ♀ 7-2-39 Bahāwalpūr town environs (III-II); 129 ♀ 16-2-39 Bhūng (III-II); 230 ♂ 5-3-39 Chāchrān (III); 311 ♀ 19-3-39 Bahāwalnagar (III-II).

Elsewhere noted: Hārūnābād (I); Bahāwalpūr town (III).

[Measurements :

	Bill	Wing	Tail
1 ♂	23	73	68 mm.
3 ♀♀	20.5-21	66-69	60.5-64 mm.—H. W.]

Obviously winter visitor. Common. Invariably present on shisham trees in forest plantations, in groves about villages and in Inspection Bungalow compounds even where these are isolated by miles of inhospitable semi-desert or treeless cultivated tracts. The birds were met with singly working their way up the tree-trunks and along the boughs in short spurts like a nuthatch and extracting tiny insects from the crevices of the bark.

Saxicola caprata bicolor Sykes. The North-Indian Pied Bush-Chat.

Specimens collected: 17 ♂ 29-1-39 Bahāwalpūr town environs (III); 86 ♂ 8-2-39 Dera Bakha (Bwp. town environs), (II); 141 ♀ 18-2-39 Daulatpūr (Sukkur Dist. Frontier), (III-II).

Elsewhere noted: Jajjah-Abbāsiān, Bahāwalnagar (III-II); Hārūnābād (I).

[Measurements :

	Bill	Wing	Tail
2 ♂♂	13-14.5	71.5-73.5	50-55 mm.
1 ♀	13.3	71.5	50.5 mm. —H. W.]

Rather rare in the environs of Bahāwalpūr town, but common elsewhere in III and II as well as in the colonised parts of I. Noted as paired off, with males in full song, from about the first week of March. Partial to the tamarisk growth in the neighbourhood of *dhands,* canals and cultivation, commonly perching on the tips of the long, coarse grass clumps (*Saccharum*) growing on and about the margins and *bands.*

The white in the wings of the male is displayed prominently while he is singing, with tail depressed and wings partly drooping at the sides. The tail is nervously twitched open now and again. In this race the white underparts of the male extend in life well up to the lower breast, reminiscent rather of *Œnanthe picata.* Its extent can be very considerably diminished in a badly made-up skin.

As early already as 8 February the testes of a specimen had commenced to mature. They measured 4×3 mm.

Saxicola torquata indica (Blyth). The Collared Bush-Chat.

Specimens collected: 16 ♂ 29-1-39 Bahāwalpūr town environs (III-II); 105 ♂ 13-2-39 Bhūng (III-II); 265 ♀ 13-3-39 Hārūnābād (I).

Elsewhere not noted.

[Measurements :

	Bill	Wing	Tail
2 ♂♂	14-14.5	69-73	48-50.5 mm.
1 ♀	13.5	70	50 mm.

According to the criteria given by Ticehurst (*Ibis* 1938, pp. 338-341) No. 16 would pass as *S. t. maura* as it has a wing measurement of 73 mm. and the white on the base of the tail feathers is more extensive than in No. 105 (wing 69 mm.), but the difference between the two forms is exceedingly slight and

I am not sure how far they are worth recognition. No. 265, the female with wing of 70 mm., would also seem to be *maura* as it is larger than a large series of Himālayan breeding birds—H. W.]

Evidently winter visitor. Not common. Met with singly about fallow canal cultivation, the edge of tamarisk beds in the riverain, and dry reed-beds on the margins of *dhands*.

Œnanthe picata (Blyth). The Indian Pied Chat.

Specimens collected: 23 ♀, 37 ♂ 1-2-39 Bahāwalpūr town environs (II); 122 ♂ 15-2-39 Bhūng (III-II); 189 ♂ 27-2-39 Manthār (I).

Elsewhere noted: Yazmān (I); Between Jajjah-Abbāsiān and Khānpūr (II-III).

[Measurements:

	Bill	Wing	Tail
3 ♂♂	17.5	90.5-93	62-66.5 mm.
1 ♀	17	88.5	62.5

No. 23 is a typical female of the type in which the lower throat and upper breast are a sooty black, almost but not quite so dark and pure as in the male.—H. W.]

Numerically not abundant but generally distributed in its accustomed biotope—stony semi-desert, and desert with sparsely scrubbed sand-dunes. The males (which appeared to predominate), can be told from other confusing black-and-white chats by their black head, crown, back and breast and white rump, tail and underparts. The tail has a subterminal black band.

Met with singly perched on desert bushes, dipping forward violently from time to time like the Redstart or the Brown Rock-Chat (*Cercomela*), especially when alarmed. Usually very wild. Among the sand-dunes in the remoter portions of the desert this chat was, along with *Sylvia nana,* about the only bird species found.

These desert-haunting black-and-white chats present some of the most glaring anomalies in the colouration of desert animals. Their diurnal habits make them conspicuous (at least they are by no means inconspicuous) in an environment of pale coloured sand, yet we have no evidence to show that they are handicapped in any way. The desert is as much their habitat as of the most effacingly coloured species.

Œnanthe capistrata (Gould). The White-headed Chat.

Specimens collected: 20 ♀ 29-1-39 Bahāwalpūr town environs (II); 273 ♀ 13-3-39, 297 ♂ 16-3-39 Hārūnābād (I).

Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
1 ♂	18	98	69 mm.
2 ♀♀	16-16.5	88-90	60-66 mm.

These females are of the rather pale brown type with hair-brown ear coverts which are usually recognisable without difficulty as the females of this species.—H. W.]

Rare in Bahāwalpūr State. Frequents semi-desert and fallow land in desert canal cultivation. Biotope same as that of *Œ. picata.* Usually seen singly. Shy. The male is coloured like *Œ. picata,* but has a whitish grey-buff cap.

The specimen of 16 March was very fat and evidently preparing to emigrate.

Œnanthe deserti atrogularis (Blyth). The Desert Wheatear or Gould's Desert Chat.

Specimens collected: 15 ♂ 29-1-39, 46 ♀ 3-2-39 Bahāwalpūr town environs (II); 52 ♂ 4-2-39, 87 o? 8-2-39 Dera Bakha (II).

Elsewhere noted: Bhūng (III-II); Manthār, Yazmān (I).

[Measurements:

	Bill	Wing	Tail
3 ♂♂	16	93.5-96.5	60.5-64 mm.
1 ♀	17	94	64.5 mm. —H. W.]

Fairly common. Met with singly in semi-desert, and amongst rippled sand-dunes covered with half-buried scanty bushes.

Œnanthe xanthoprymna chrysopygia (De Fil.). The Red-tailed Chat.

Specimens collected: 42 ♀, 43 ♀ 3-2-39 Bahāwalpūr town environs (II); 88 ♂ 8-2-39 Dera Bakha (II); 92 ♀ 10-2-39 Yazmān (I); 190 ♂, 191 ♀ 21-2-39 Manthār (I).
Elsewhere not noted.

[Measurements :

	Tail	Wing	Bill
2 ♂♂	19.5	94.5-96.5	61.5-63 mm.
4 ♀♀	18.5-19.5	91-95	58.5-63 mm. —H. W.]

The Red-tailed Chat was not uncommon in the sand-dune facies of the desert, and was occasionally also observed on the outskirts of desert canal cultivation. It was met with singly perched on low bushes or running on the ground, often far out in the dreary rolling expanses of desert where, besides an occasional *Œ. picata* and a stray *Sylvia nana,* no other bird life was visible. In Sind, according to Ticehurst, it is associated chiefly with rocky ground and rocky hills. The birds were always inordinately shy, for some unaccountable reason even more so than the other species of chats. Two specimens, when winged, ran swiftly and made straight for gerbille holes in a seemingly premeditated manner and disappeared deep down the maze of subterranean tunnels.

Phœnicurus ochruros phoenicuroides (Moore). The Kashmir Redstart.

Specimens collected: 10 ♂ 28-1-39 Bahāwalpūr town environs (III); 133 ♂, 134 o? 16-2-39 Bhūng (III-II); 155 ♀ 21-2-39, 182 o? 25-2-39 (Manthār (I); 235 ♀ 5-3-39 Chāchrān (III).
Elsewhere noted: Hārūnābād (I); Bahāwalnagar (III-II).

[Measurements :

	Bill	Wing	Tail
3 ♂♂	15-15.5	83-86	62.5-63 mm.
2 ♀♀	15-15.5	77-81.5	56.5-60 mm. —H. W.]

Common in riverain tamarisk jungle and babool trees along the canals. Also about villages and cultivation. The notes commonly uttered (by the male!) are a mousy *whit* . . . *whit* . . . *whit* etc. like an unoiled, squeaking bicycle wheel. The interval between one *whit* and the next is just about the time taken by one revolution of the wheel when ridden at an easy pace.

Cyanosylvia suecicia ssp? . The Bluethroat.

Specimens collected: 27 ♂ 1-2-39 Bahāwalpūr town environs (III); 104 ♂ 13-2-39 Bhūng (III-II); 195 o? 1-3-39 Jajjah-Abbāsiān (III-II); 237 ♂ 5-3-39 Chachran (III); 277 ♂ 14-3-39 Hārūnābād (I).

[No. 195 (Bill 16, Wing 71, Tail 58 mm.) is clearly *pallidogularis.* The remainder (4 ♂♂ Bill 15.5-17; Wing 72-78; Tail 55-56 mm.) are either in winter dress or heavy moult on chin and throat, and I am unable to identify them with certainty but they evidently are not *pallidogularis.*—H.W.]

Not numerically abundant anywhere, but fairly common and generally distributed in the better watered portions of the State. Riverain tamarisk beds, and tamarisk scrub growing on the edge of wheat cultivation or *dhands* are favourite resorts.

Ticehurst found the prevailing race in Sind to be *pallidogularis.* (*Ibis,* 1922, p. 638).

Saxicoloides fulicata cambaiensis (Lath.). The Brown-backed Indian Robin.

No specimens collected.

Noted in the environs of Bahāwalpūr town, at Bhūng and Jajjah-Abbāsiān. Uncommon. Met with sporadically about the canals, in scrub country dotted with clumps of tall grass. It has not as yet penetrated to Hārūnābād.

Copsychus saularis saularis (Linn.). The Indian Magpie Robin.

The only example seen during the entire Survey was in the Inspection Bungalow compound at Bahāwalnagar on 21 March. No others were met with even in this locality.

It is of doubtful or exceptional occurrence in Sind also, although the *Fauna* 'Distribution' implies that it is common.

Turdus atrogularis Temm. The Black-throated Thrush.

Specimen collected: 28 ♂ 1-2-39 Bahāwalpūr town environs (III).
Elsewhere noted: Chāchrān (III).

The specimen was shot from a scattered party of 4 birds, hopping about and feeding on the ground in young gram, mustard and vetch crops and on sparsely scrubbed-fallow fields in the Sutlej riverain. The only other example seen (5 March—Chāchrān) was in identical facies near the Chenāb river.

Prunella atrogularis atrogularis (Brandt). The Black-throated Hedge-Sparrow.

Specimen collected: 49 ♂ 3-2-39 Bahāwalpūr town environs (III-II).
Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
1 ♂	—	76	64.5 mm.

The races of this species are hard to discriminate, but the paler and more lightly streaked back and the paler 'halo' round the black throat-patch seem to distinguish the specimen from the race *huttoni* which is the common form in N.-W. India. The typical race is only a straggler to N.-W. India. There is a female in the British Museum from Gilgit 5000′ 9 Jan. 1879, and Mr. H. W. Waite obtained another female at Jhelum on 17 Feb. 1926. A male in my own collection (Mochiwala, Jhang, 25 Jan. 1919) may well also belong to the typical form.—H. W.]

The specimen was obtained from a small party feeding on the ground at the edge of canal cultivation in sandy semi-desert. It was fat.

Muscicapa parva parva (Bechstein). The European Red-breasted Flycatcher.

Specimens collected: 78 ♀ 7-2-39 Bahāwalpūr town environs (III); 288 ♂, 289 ♂, 290 ♂ 15-3-39 Hārūnābād (I); 315 ♂ 19-3-39 Bahāwalnagar (III).

[Measurements:

	Bill	Wing	Tail
4 ♂♂	13.5-14	67.5-72.5	49.5-54 mm.
1 ♀	13.5	71	54 mm.

It may be of interest to remark for the benefit of Indian ornithologists that in May 1936 I was on the breeding ground of this species in Eastern Poland near Tarnopol and Zalisczczyki and collected a series of males which by their organs were all clearly breeding. Half of these birds were red-breasted and of the type familiar to us in India (e.g. Nos. 288, 290 and 315 above). Other breeding males were, however, of two types, and these by their more worn wings and tails were evidently first year birds though the distinctive juvenile spotting had been worn off the tertiaries and coverts. One of these types was indistinguishable from the adult female. The second was very similar to the female but the throat and breast were washed with reddish-fulvous, though not so rich in tint as in the adult male. The grey border was absent. No. 289 represents this type.—H. W.]

This flycatcher was not uncommon in the better wooded portions of the State. It was particularly partial to shisham trees whether growing in groves about villages and cultivation, in the compounds of Inspection Bungalows or in forest plantations, both in the riverain as well as the colonised desert tracts. The birds were noted as having become more abundant from about the middle of March.

Three of the March specimens, as also the majority of males observed in the second half of that month, were in freshly moulted, perfect red-breasted plumage.

The specimen of 19 March moreover, was very fat suggesting that the birds were preparing to emigrate.

Leucocirca aureola aureola (Less.). The White-browed Fantail Flycatcher.

Specimens collected: 130 ♂, 131 ♀ 16-2-39 Bhūng (III-II).
Elsewhere noted: Manthār (I), Jajjah-Abbāsiān (II-III), Bahāwalnagar (III-II).

[Measurements:

	Bill	Wing	Tail
1 ♂	15	84	98 mm.
1 ♀	—	80.5	97 mm. —H. W.]

Not common, but a pair or so usually met with in the walled-in fruit gardens in villages even where these are isolated by miles of semi-desert and inhospitable treeless country from its next likely habitat. It frequents tamarisk jungle by canals and bordering the *dhands* formed by seepage from these or from the backwaters of the great rivers. It was less uncommon about Bahāwalnagar where the Forest Department's shisham plantations were its favourite haunts. Here, on 19 and 20 March respectively two nests under construction, nearly completed, were observed both about 15 ft. up in shisham trees.

The male shot on 16 February had testes measuring 8×4 mm., therefore with gonad development considerably more advanced than its mate whose ovaries were merely granular. This pair was evidently preparing to breed.

Lanius excubitor lahtora (Sykes). The Indian Grey Shrike.

Specimens collected: 14 ♀ 29-1-39 Bahāwalpūr town environs (II); 218 ♂ 3-3-39. Jajjah-Abbāsiān (II).
Elsewhere noted: Yazmān (I), Hārūnābād (I).

[Measurements:

	Bill	Wing	Tail
1 ♂	24.5	115	117.5 mm.
1 ♀	24	111	110.5 mm. —H. W.]

Fairly common, but not abundant. Solitary examples occasional or frequent in desert or semi-desert facies. The specimen of 3 March had maturing gonads measuring 10×6 mm.

Lanius vittatus Valenciennes. The Bay-backed Shrike.

Specimen collected: 262 ♀ 13-3-39 Hārūnābād (I).
Elsewhere noted: Jajjah-Abbāsiān (II-III).

[Measurements:

	Bill	Wing	Tail
1 ♀		87	90 mm. —H. W.]

Uncommon. Only 5 solos observed during the entire Survey. Usually in babool trees about semi-desert canal cultivation.

Lanius schach erythronotus (Vigors). The Rufous-backed Shrike.

Specimen collected: 259 ♂ 9-3-39 Lāl Sohāra (II).

[Measurements:

	Bill	Wing	Tail
1 ♂	21	94	115 mm. —H. W.]

Rare. The specimen was the first and only shrike of this species met with in Bahāwalpūr State. It was among young date palms lining a canal. Testes 3×2 mm.

Lanius isabellinus Hempr. & Ehr. The Pale Brown Shrike.

Specimens collected: 13 ♂ 29-1-39, 22 ♀ 1-2-39, 66 ♀ 6-2-39 Bahāwalpūr town environs (III-II); 96 ♀ 10-2-39 Yazmān (1); 137 ♂ 17-2-39 (Bhūng (III-II); 258 ♀ 9-3-39 Lāl Sohāra (II); 275 ♀ 14-3-39 Hārūnābād (I).

[Measurements :

	Bill	Wing	Tail
2 ♂♂	19·5-20	91-93	80-82 mm.
5 ♀♀	18-19·5	89·5-92	74-82 mm. —H. W.]

Common. Occasional solos alternating with or in the same facies as *L. e. lahtora,* i.e. on the edge of canal cultivation and fallow fields in desert and semi-desert. The specimen of 14 March was very fat.

Pericrocotus brevirostris brevirostris (Vigors). The Indian Short-billed Minivet.

Specimens collected: 196 ♂, 197 ♀, 198 ♀, 199 ♀ 1-3-39 Jajjah-Abbāsiān (II-III); 305 ♀, 306 o? 19-3-39 Bahāwalnagar (III-II).
Elsewhere noted: Bahāwalpūr town and environs (III-II).

[Measurements :

	Bill	Wing	Tail
1 ♂	14·5	93	114·5 mm.
4 ♀♀	14·5-15·5	89·5-94	100-114 mm.

No. 196 is in female-like plumage, but it was sexed by Mr. Sálim Ali personally and the correctness of this determination is confirmed by the pinkish-red tinge on odd feathers both of the forehead and of the chin and throat—a tinge of colour which is found in none of the rest of the series; yet various new feathers which are coming in quill on the chin and throat will evidently be yellow and not red. Yellow males of this type are usually and naturally described as 1st year birds, but the possibility should be borne in mind that they are males which will always retain the female type of plumage, i.e., that males in this species may be to a limited extent dimorphic.—H. W.]

Not uncommon in the better wooded portions such as among the shishams in compounds and forest plantations, and in tamarisk jungle by *dhands* and backwaters of rivers. Mixed flocks of red and yellow birds were met with busily hunting for insects among the foliage or flying from tree to tree uttering a quick-repeated musical *wee-twee?*

Its status in Bahāwalpūr is uncertain. In Sind, according to Ticehurst, it is a winter straggler from the Himālayas. (*Ibis,* 1922, p. 612.)

Specimen No. 305 (19 March) was very fat.

Pericrocotus peregrinus pallidus Stuart Baker. The Sind Small Minivet.

Specimen collected: 82 ♂ 7-2-39 Bahāwalpūr town environs (III).
Elsewhere noted: Hārūnābād (I).

[Measurements :

	Bill	Wing	Tail
1 ♂	12·5	69	76 mm.—H.W.]

Rare. Small parties were seen on a few occasions only, in Shisham plantations and in groves of trees and wooded compounds.

Dicrurus macrocercus albirictus (Hodgson). The Himalayan Black Drongo.

Specimen collected: 47 ♂ 3-2-39 Bahāwalpūr town environs (II-III).
Elsewhere noted: Yazmān (I); Bhūng (III-II); Hārūnābād (I); Bahāwalnagar (II-III).

[Measurements :

	Bill	Wing	Tail
1 ♂	23	153	106 mm.—H. W.]

The Black Drongo was noted as practically absent in Bahāwalpūr town and environs between 29 January and 7 February. Indeed, during these 9 or 10 days the specimen (very fat!) was the only example seen. After the latter date it was somewhat more in evidence—singly or in twos and threes by canal cultivation—but still far from common. The same proved to be the case over the rest of the State also, though in the neighbourhood of Bahāwalnagar it was perhaps slightly

more numerous than elsewhere. The scarcity of this species, so plentiful in cultivated areas over the greater part of India needs explaining. The more so as in the adjoining province of Sind Ticehurst found it 'very common everywhere except in the hills and barest deserts.' (*Ibis*, 1922, p. 546.)

Acrocephalus agricola (Jerdon). The Paddy-field Warbler.

Specimen collected : 268 ♂ 13-3-39 Hārūnābād (I).

[Measurements :

	Bill	Wing	Tail
1 ♂	15.5	59	56 mm.—H. W.]

A solo, flushed in oat field.

Orthotomus sutorius guzurata (Latham). The Tailor-Bird.

Specimen collected : 239 ♂ 5-3-39 Chāchrān (III).
Elsewhere noted: Bahāwalpūr town (III), Bhūng (III-II), Jajjah-Abbāsiān (III-II), Hārūnābād (I), Bahāwalnagar (III-II).

[Measurements :

	Bill	Wing	Tail
1 ♂	16	53	— mm.—H. W.]

On the whole rather scarce, but a pair or two were usually met with wherever green shrubbery was present as in gardens in towns and villages, shisham plantations and Inspection Bungalow compounds in canal colonies even where these were isolated by miles of semi-desert.
The gonads of the specimen were maturing. They measured 4×3 mm.

Hippolais caligata rama (Sykes). Sykes's Tree Warbler.

Specimen collected : 148 ♂ 21-2-39 Manthār (I).

[Measurements :

	Bill	Wing	Tail
1 ♂	16	60	51 mm.—H. W.]

Shot in babool tree by tributary canal. I have no other specific sight records, but feel that it may be less uncommon than this circumstance would indicate.

Cettia cettia cettioides Hume. The Eastern Bush-Warbler.

Specimens collected : 215 ♂, 216 ♂ 3-3-39 Jajjah-Abbāsiān (III-II).
Elsewhere not noted.
The specimens were obtained at Tatar *dhand* where they kept hidden amongst the partially submerged reeds and thickets at the edge of the inundated tamarisk jungle. They are great skulkers and best secured by patient waiting and watching when the restless bird will present momentary glimpses as it hops amongst the stems. Snatches of a loud, clear song were uttered by the males.

Lusciniola melanopogon mimica Madarász. The Eastern Moustached Sedge-Warbler.

Specimens collected: 210 ♀ 2-3-39, 211 ♂, 212 ♀, 213 ♀, 214 ♂ 3-3-39 Jajjah-Abbāsiān (III-II).
Elsewhere noted : Bahāwalnagar-Minchinābād (III-II).

[Measurements :

	Bill	Wing	Tail
2 ♂♂	16	64.5-65	54-57 mm.
3 ♀♀	16	60.5-62	49.5-55 mm.—H. W.]

Not uncommon at *dhands* amongst partly submerged tamarisk thickets. It picks its food from the surface of the water or the squelchy mud, clinging sideways to the reed stems or hopping amongst the root stocks with cocked tail.

Laticilla burnesi (Blyth). The Long-tailed Grass-Warbler.

Specimens collected: 307 ♀, 308 ♂, 309 ♂, 310 ♂ 19-3-39; 329 ♂, 330 ♂ 22-3-39 Bahāwalnagar (II-III).
Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
5 ♂♂	14-14.5	55-58	102-110 mm.
1 ♀		54.5	105.5 mm.—H. W.]

The Long-tailed Grass-Warbler was only met with in the environs of Bahāwalnagar. Here it frequented an open clearing in a shisham plantation littered with faggots, dry branches and stacks of firewood and interspersed with sprawling clumps of the coarse saw-edged *sarkan* grass. The species appeared to be common in this locality, but always kept to more or less identical facies. In general effect and habits this warbler seems to be midway between *Prinia sylvatica* and *Trochalopteron lineatum* now reminiscent of the one now of the other. It is a great skulker, hopping with agility in and out of the scrub and thickets and can be flushed only with difficulty. When it finally does so it is merely to fly feebly for a few yards and dive into cover again. It has a loud song which, curiously enough, is again between those of the two species mentioned.

The specimens of 19 March were breeding; they all had fully mature gonads (testes 10×8 mm., ovaries granular with largest follicle 2 mm diam.) On the same date an individual was observed carrying a caterpillar in its bill, but no nest was found.

The 2 males of 22 March had testes 5×4 mm.

Franklinia buchanani (Blyth). The Rufous-fronted Wren-Warbler.

Specimens collected: 269 ♂ 13-3-39, 276 ♂ 14-3-39 Hárūnābād (I).
Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
2 ♂♂	13.5	52.5-53.5	61-64 mm.—H. W.]

Uncommon. Met with in sparse semi-desert scrub about canal cultivation. Males in full song, and breeding evidently in progress. Testes of specimens 10×6 and 5×4 respectively.

Sylvia curruca blythi Ticeh. & Whistler. The Indian Lesser Whitethroat.

Specimens collected: 18 ♂ 29-1-39, 25 o? 1-2-39 Bahāwalpūr town environs (III-II); 135 o? 16-2-39 Bhūng (II-III); 192 ♀ 27-2-39 Manthār (I); 238 ♀ 5-3-39 Chāchrān (III); 246 ♂ 6-3-39 Jajjah-Abbāsiān (III-II); 319 ♂ 20-3-39 Bahāwalnagar (III-II).
Elsewhere noted: Hārūnābād (I).

[Measurements:

	Bill	Wing	Tail
2 ♂♂	13-13.5	64-66.5	61 mm.
3 ♀♀	12.5-13	67-67.5	54.5-59 mm.—H. W.]

A very common winter visitor. Found in tamarisk. *Capparis* and kandi (*Prosopis*) jungle and scrub, usually on the margin of *dhands* amidst semi-desert. Also amongst the partially submerged tamarisks and scrub. No. 319 was very fat. It was moulting all its rectrices simultaneously and had a fresh, partly grown stub tail.

Sylvia curruca halimodendri Suschkin. The Central Asian Lesser Whitethroat.

Specimen collected: 193 o? 27-2-39 Manthār (I).
Elsewhere not differentiated.

[Measurements:

Bill	Wing	Tail
12	69.5	59.5 mm.

It is not surprising that this race should have been obtained in Bahāwalpūr

as Mr. Waite has procured a number of examples of it in the Jhelum Salt Range and in the Shahpur and the Dera Ghazi Khan Districts.—H. W.]

This pale form of the Lesser Whitethroat, first obtained by me within the limits of India proper at Phūlji, Larkana Dist., Sind, in 1926 (*J.B.N.H.S.*, xxxii, p. 376) is evidently less rare in this part of N.-W. India than it appears to be, no doubt on account of possible confusion with *blythi* with which it corresponds both in measurements and wing formula. It is, however, much paler than *blythi* being the same in colour as *minula*.

Whitethroats, along with *Argya caudata*, were the commonest bird species in the desert about Manthār. On 27 February (when this specimen was secured) the weather was heavily overcast and there had been rain throughout the previous night. Whitethroats—especially *blythi* and *minula*—were literally swarming! The specimen was very fat.

Sylvia curruca minula Hume. The Small Whitethroat.

Specimens collected: 26 o? 1-2-39 Bahāwalpūr town environs (III-II); 53 ♀ 4-2-39 89 o? 8-2-39 Dera Bakha (II); 120 ♀ 15-2-39 Bhūng (II-III); 145 o? 18-2-39 Daulatpur (Sukkur Dist. frontier, III); 152 ♀ 21-2-39, 165 ♀ 22-2-39 Manthār (I).

[Measurements:

	Bill	Wing	Tail
4 ♀♀	10.5-12	60-63	52.5-55 mm.—H. W.]

A common and abundant species. Met with singly amongst *Capparis*, tamarisk and kandi (*Prosopis*) scrub in I, II and III. It is frequently found miles out in absolute sand-dune desert amongst the sparse stunted *Capparis* bushes half buried in mounds of wind-blown sand. It is easily differentiated in the field form *blythi* by its smaller size and markedly paler colouration.

Sylvia nana nana (Hempr. & Ehren.). The Desert Warbler.

Specimens collected: 32 ♂, 33 ♀ 2-2-39 Bahāwalpūr town environs (II); 101 ♂, 102 ♂ 13-2-39 Bhūng (II); 163 ♂, 164 ♂ 22-2-39 Manthār (I).

Colours of soft parts: Iris bright lemon-yellow; legs and feet yellowish flesh colour; bill same but with upper mandible brown.

[Measurements:

	Wing	Bill	Tail
5 ♂♂	11-11.5	59-60.5	47.5 mm.—H. W.]
1 ♀	11	57	46-51 mm.

Common in I and II. Seen singly hopping about on the sand amongst the bases of scanty *Salsola*, *Capparis* and *Prosopis* bushes growing on the sand-dunes and mounds. Its movements are somewhat reminiscent of *Scotocerca*. Often met with miles out in the desert where the only other birds were perhaps a stray *Œnanthe capistrata* or a Small Whitethroat.

Phylloscopus griseolus Blyth. The Olivaceous Tree-Warbler.

Specimen collected: 318 ♂ 20-3-39 Bahāwalnagar (III).
Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
1 ♂	14	67	52 mm.—H. W.]

The first and only example met with in Bahāwalpūr State. Very fat and evidently on passage. Its habits differed from those of other Phylloscopi in that it kept to tree-trunks more than to the foliage, running up and down them rather like a Tree-Creeper.

Phylloscopus collybita tristis Blyth. The Brown Willow-Warbler or Siberian Chiffchaff.

Specimens collected: 79 ♂ 7-2-39 Bahāwalpūr town environs (III); 112 ♂, 113 ♀ 14-2-39, 121 ♂ 15-2-39 Bhūng (III-II); 166 ♂ 22-2-39, 186 ♀ 26-2-39

Manthār (I); 222 ♀ 4-3-39 Jajjah-Abbāsiān (III-II); 252 ♀, 253 ♀ 9-3-39 Lāl Sohāra (II); 270 ♂ 13-3-39, 286 ♀ 14-3-39 Hārūnābad (I); 312 ♂ 19-3-39 Bāhāwalnagar (III-II).

[Measurements :

	Bill	Wing	Tail
6 ♂♂	11-12	62-65	49-52 mm.
6 ♀♀	11-12	57-62	44-48 mm.—H. W.]

Very common. Singly or twos and threes amongst roadside shisham or babool trees, in tamarisk and kandi riverain jungle, and in wheat and cotton fields. In the latter, especially after the crop had been picked, quite large scattered gatherings were occasionally observed hunting insects on the bare stalks. The birds were also plentiful on the dry lotus stalks and other partially submerged vegetation in the *dhands* at Jajjah-Abbāsiān and elsewhere.

Four of the specimens obtained between 15 February and 9 March were very fat and evidently getting ready to emigrate. According to Ticehurst, most birds have left Sind by the last week in March. (*Ibis*., 1922, p. 563).

Phylloscopus neglectus neglectus Hume. The Plain Willow-Warbler.

Specimens collected: 1 ♂, 4 ♀ 28-1-39, 80 ♂ 7-2-39 Bahāwalpūr town environs (III).

[Measurements :

	Bill	Wing	Tail
2 ♂♂	10-10.5	52.5-53	40.5-41 mm.
1 ♀	10.5	49	38 mm.—H. W.]

Not uncommon in the environs of Bahāwalpūr town, but curiously enough not noted elsewhere within the State. Single birds were seen in tamarisk beds along the Sutlej River, and in shisham plantations.

Specimen No. 313 o? 19-3-39 Bahāwalnagar, of a Phylloscopus smaller than *tristis* more olive above with a faint coronal band, appears somehow to have gone astray and Mr. Whistler evidently never received it. It was a solo shot in a shisham plantation.

Prinia gracilis lepida Blyth. The Indian Streaked Wren-Warbler

Specimens collected: 2 ♀, 3 ♂ 28-1-39, 38 ♂ 2-2-39 Bahāwalpūr town environs (III-II); 90 ♂ 8-2-39 Dera Bakha (II); 142 ♂ 18-2-39 Daulatpūr (Sukkur Dist. frontier III); 156 o? 21-2-39 Manthār (I); 260 ♂ 9-3-39 Lāl Sohāra (II); 266 ♀ 13-3-39 Hārūnābād (I)

[Measurements :

	Bill	Wing	Tail
5 ♂♂	10.5-11	43-46	67.5-72 mm.
3 ♀♀	10-10.5	40.5-45	58.5-66 mm.—H. W.]

Common in scrub and grass bordering canals and canal cultivation. Its call (song) is almost indistinguishable from that of *Prinia inornata*, and in habits also the two species are very similar. In appearance it is a small replica of *Argya caudata*.

As early as 2 February breeding seemed imminent. The gonads of No. 38 were enlarged to 3×2 mm. No. 260 (9 March) as well as 266 (13 March) were evidently breeding birds. The testes of the former measured 6×4 mm.; the ovary of the latter coarsely granular. About this period the birds had paired off, with the males constanly warbling excitedly from exposed perches such as the top of a bush.

A nest was found on 13 March (Hārūnābād). It was a small oval pouch of grass strips, bound with vegetable down, with a lateral opening near the top, wedged into the base of a clipped clump of saw-edged *sarkan* grass (*Saccharum*) growing on the bank of a minor canal. Both parents were busy feeding the 2 (or 3?) partly fledged chicks within.

Prinia inornata terricolor (Hume). The Indian Wren-Warbler.

Specimens collected: 126 ♀, 127 ♂ 16-2-39 Bhūng (III-II); 143 ♂ 18-2-39 Daulatpūr (Sukkur Dist. frontier, III); 267 ♀ 13-3-39 Hārūnābād (I),

[Measurements :

	Bill	Wing	Tail
2 ♂♂	13-14	50-53	76 mm.
2 ♀♀	13	48.5	75 mm.—H. W.]

Fairly common and found in the same facies as *Prinia gracilis* viz. wheat, gram and oat fields, especially about minor canals, and with the bordering tamarisk scrub intermingled with clumps of *sarkan* grass. The two species were frequently met with in the same patch. Nos. 126 and 127, in fresh pre-nuptial plumage, were strikingly yellow on the underparts when freshly killed.

The gonads of specimen No. 143 (18 February) were enlarging preparatory to breeding. They measured 4×3 mm.

Cisticola juncidis [cursitans (Frankl.)]. The Rufous Fantail Warbler.

No specimens. The unmistakable *chip . . . chip . . . chip* uttered by this warbler in its wandering, zig-zag overhead flight was heard above standing wheat crops in the Chenab riverain at Chāchrān on 5 March.

Ticehurst (*Ibis*, 1922, p. 552) describes this warbler as a common resident in Lower Sind but apparently scarcer in Central and Upper Sind. In the last, T. R. Bell found it breeding in February.

Prinia socialis or **Prinia flaviventris sindiana** Ticeh.?

I have a record of a fleeting glimpse of a warbler which may be either one or the other of the above, in some clumps of tall *sarkan* grass by cultivation at Jajjah-Abbāsiān (III-II) 6-3-39.

Pastor roseus Linn. The Rosy Pastor.

During the entire period the Survey was in the field (27 January to 24 March) no Rosy Pastors were seen in Bahāwalpūr State. I can only account for this absence on the assumption that the Pastor is purely a passage migrant in Bahāwalpūr and that the end of March was naturally too early for its spring northward movement.

According to Ticehurst (*Ibis*, 1922, p. 616) the Pastor leaves Lower Sind regularly about 6 May. A week later it has gone from Upper Sind returning again to its Indian winter quarters as early as the second or third week of July. The last date recorded by Mr. Whistler in the almost adjacent Jhang District of the Punjab is 14 May.

Sturnus vulgaris poltaratzskyi Finsch. Finsch's Starling.

Specimens collected: 12 ♀ 29-1-39 Bahāwalpūr town environs (III); 103 ♀ 13-2-39 Bhūng (III-II).

Elsewhere noted: Jajjah-Abbāsiān (III-II).

[Measurements :

	Bill	Wing	Tail
2 ♀♀	29-30.5	126-131	61-66 mm.—H. W.]

Not very common, but small flocks were frequent in suitable terrain. The birds sauntered about and dug with their bills on the moist grassy edges of the drying-up *dhands*.

A grove of shisham trees in Bhūng village was the community roost of the starling population for miles around. Flock upon flock flighted in from all quarters at sunset every evening till the bare tree-tops were thick and black with their multitudes. For the size of the assemblages, however, and contrary to the case with roosting mynas, the birds produced surprisingly little noise.

Acridotheres tristis tristis (Linn.). The Common Myna.

No specimens.

Noted: Bahāwalpūr town and environs (III-II); Bhūng (III-II); Manthār (I); Jajjah-Abbāsiān (III-II); Ḥārūnābād (I); Bahāwalnagar, Minchinābād (III-II).

The myna is common in and about the older and well established towns, villages and cultivated tracts of the State, and is steadily advancing into the 'hinterland' with the opening up and colonisation of desert and semi-desert areas. It has, as yet, not penetrated to Yazmān, the youngest of the desert colonies investigated by the Survey. At Manthār, which represents the secondary stage of this evolution of the desert, it was met with in small numbers about the outlying homesteads of the settlers. At Hārūnābād, which may be considered the climax of desert colonisation under the new irrigation schemes, it has already fairly established itself though as yet only in small numbers.

Acridotheres ginginianus (Latham). The Bank Myna.

No specimens.

Noted: Dera Bakha (II); Bahāwalpūr town environs (III-II).

Sparsely and locally distributed. Small numbers were observed in attendance on grazing cattle around the outskirts of villages, or following the plough on fallow land on the margins of *dhands*.

Ploceus philippinus philippinus (Linn.). The Baya or Common Weaver-Bird.

No specimens.

I saw no Bayas at all during the time I was in Bahāwalpūr State, but evidence of their presence in small numbers at other seasons was not wanting. For instance on 16 February (Bhūng) two or three old nests were observed hanging on a babool by a dry sandy canal. These nests were examined and found to be made of strips of paddy leaf. Enquiry showed that water is let into this canal between April and October and that paddy is cultivated on the adjoining land during that time.

At Daulatpūr (Sukkur District frontier—Indus riverain), a colony of 20 old nests was noted on a shisham tree. No Bayas were about, but local information that small numbers were still present in the locality was confirmed by a partly desiccated specimen killed by the local zamindar's falcon which I found lying on top of his falcon shed. Evidently the baya is a marked local migrant in Bahāwalpūr as elsewhere, its movements—at least at nesting time—being largely controlled by the incidence of paddy cultivation.

Ploceus manyar flaviceps (Lesson). The Streaked Weaver-Bird.

Specimens collected: 321 ♂, 322 ♂, 323 ♀ 21-3-39 Bahāwalnagar (III-II). Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
2 ♂♂	18.5-19.5	72-72.5	45-47 mm.
1 ♀	18	68.5	42 mm.—H. W.]

Several small flocks observed frequenting extensive bulrush beds in a *dhand*. The breeding season was evidently at hand. The males had acquired breeding plumage and the gonads of the 2 specimens showed indications of enlargement, measuring 2×1 mm.

The difference in the breeding seasons of the 2 species of Baya, due to their respective ecological requirements—paddy leaf for nest material in *philippinus* and reeds and bulrushes for nest sites in *manyar*—is noteworthy.

Uroloncha malabarica (Linn.). The White-throated Munia.

Specimen collected: 278 ♂ 14-3-39 Hārūnābād (I).
Elsewhere noted: Bahāwalpūr town environs (III).

[Measurements:

	Wing	Bill	Tail
1 ♂	11	58	50.5 mm.—H. W.]

Uncommon. Small flocks.

The testes of the specimen were enlarged to 4×3 mm. On 16 March a pair was observed nest-building about 6 ft. up in a small ber tree (*Zizyphus*) near the Inspection Bungalow at Hārūnābād.

Amandava amandava amandava (Linn.). The Indian Red Munia.

Specimens collected: 224 ♀, 225 ♀, 226 ♀ Jajjah-Abbāsiān (III-II); 324 ♂ 21-3-39 Bahāwalnagar (III-II).

Elsewhere noted: Manthār (I).

[Measurements:

	Bill	Wing	Tail
1 ♂	10.5	49	38.5 mm.
3 ♀♀	10	48.5-49.5	36-36.5 mm.—H. W.]

Occasional small flocks seen amongst reeds and bulrushes at *dhands*, or among clumps of *sarkan* grass lining the minor tributary canals through cultivation and semi-desert country. Towards the end of February and in the early part of March most males were in the intermediate plumage, i.e. rather like the female but with a crimson band down centre of abdomen. By the 3rd week of March the males had acquired breeding plumage and were observed singing from the tips of reed stalks.

The Yellow-throated Sparrow *Gymnorhis xanthocollis* a marked local migrant elsewhere, was definitely absent in Bahāwalpūr State during the period of the Survey.

Passer domesticus indicus Jardine & Selby. The Indian House-Sparrow.

Specimen collected: 50 ♂ 4-2-39 Dera Bakha (II)- [Bill 13.5; Wing 78.5; Tail 56.5 mm.].

Passer domesticus parkini Whistler. The Kashmir House-Sparrow.

Specimens collected: 51 ♀ 4-2-39 Dera Bakha (II); 153 ♀, 154 ♀ 21-2-39 Manthār (I); 256 ♀, 257 ♂, 9-3-39 Lāl Sohāra (II).

[Measurements:

	Bill	Wing	Tail
1 ♂	14.5	80.5	59 mm.
4 ♀♀	13.5-15	74.5-76	52-57 mm.

It is difficult to be certain of identifying these females in the absence of any guide as to whether they belonged to the resident population or were migrants, but on the whole they appear to be *parkini*.—H. W.]

Elsewhere noted (subspecies?): Bahāwalpūr town; Yazmān (I); Bahāwalnagar town.

Common in towns and villages in all the three tracts. Also seen about outlying homesteads in the canal colonies and in the country surrounding cultivation, often miles out in desert facies. Flocks of 20 to 100 or more, often intermixed with *Passer hispaniolensis*.

At Manthār large flocks of sparrows gathered every evening to roost among *Capparis* bushes growing on sand-dunes. The din they set up sounded in the distance rather like that of a building Baya colony.

Commencement of gonadal development was noticeable in the specimens of 9 March: testes 3×2 mm.; ovary granular.

As no specimens were actually collected within the towns or villages I am unable to say definitely that the resident race is *indicus*, which is presumably the case.

Passer pyrrhonotus Blyth. The Sind Jungle-Sparrow.

Specimens collected: 29 ♂, 30 ♂ 1-2-39, 74 ♀, 75 ♀ 7-2-39 Bahāwalpūr town environs (III-II).

[Measurements:

	Bill	Wing	Tail
2 ♂♂	12	67-70	49-55 mm.
2 ♀♀	12	63-65	48-49 mm.—H. W.]

Very locally distributed. Not uncommon in the environs of Bahāwalpūr town. Flocks among *Capparis* and *Salvadora* bushes and jungle in semi-desert.

Passer hispaniolensis transcaspicus Tschusi. Tschusi's Sparrow.

Specimens collected: 84 ♂, 85 ♂ 8-2-39 Dera Bakha (II); 254 ♂, 255 ♂ 9-3-39 Lāl Sohāra (II).
Elsewhere noted: Yazmān (I).

[Measurements:

	Bill	Wing	Tail
4 ♂♂	15	80-83	57-62 mm.—H. W.]

Not uncommon. In small flocks as well as large ones of a hundred or more, frequently in association with *P. d. parkini*, in the proximity of canal cultivation in desert and semi-desert.
Gonads of the specimens of 9 March had commenced to enlarge. In both cases they measured 4×3 mm.

Emberiza cia par Hartert. The Transcaspian Meadow Bunting.

Specimens collected: 48 ♂ 3-2-39 Bahāwalpūr town environs (III-II); 158 ♀ 21-2-39, 183 ♀ 25-2-39 Manthar (I); 240 ♂ 5-3-39 Chāchrān (III-II); 249 ♀ 9-3-39 Lāl Sohāra (II); 271 ♂ 13-3-39 Hārūnābād (I).
Elsewere noted: Bahāwalnagar (III-II).

[Measurements:

	Bill	Wing	Wing
3 ♂♂	13-13.5	80-81.5	79-81 mm.
3 ♀♀	13.5-14	85-89	72.5-77 mm.—H. W.]

Generally distributed, but not abundant numerically. Single birds, pairs or small parties were sparingly met with in semi-desert, and in the neighbourhood of desert canal cultivation. As a rule the birds were very shy.
The only instance of any departure in the gonads from the absolute quiescent condition was No. 240 (5 March) with testes measuring 2×1 mm.

Emberiza striolata striolata (Licht.). The Striolated Bunting.

Specimens collected: 184 ♂ 25-2-39 Manthār (I); 247 ♂, 248 ♂ 9-3-39 Lāl Sohāra (II).
Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
3 ♂♂	11.5	77-80.5	59-63 mm.—H. W.]

The specimens, with the addition of one example that was with No. 184, represent all I saw of the Striolated Bunting in Bahāwalpūr State. On both occasions the birds were observed in the vicinity of canals with tamarisk scrub and *sarkan* grass clumps at hand. In flight, and at a distance, the rufous wings and general effect are very reminiscent of the female Crested Bunting (*Melophus*), minus crest.
The testes of the 9 March specimens measured 2×1 mm., therefore indicating the commencement of maturity.

Riparia paludicola brevicauda Horsfield. The Indian Sand Martin.

Specimens collected: 227 ♀, 228 ♀ 4-3-39 Jajjah-Abbāsiān (III-II); 236 ♂ 5-3-39 Chāchrān (III).
Elsewhere noted: Bahāwalpūr town environs (III).

[Measurements:

	Bill	Wing	Tail
1 ♂	8	93.5	38 mm.
2 ♀♀	8-8.5	92.5-96	36.5-40 mm.—H. W.]

Common in the riverain tract. A colony of some 30 to 50 nest tunnels was observed in the vertical face of a sandbank in the Sutlej river near Bahāwalpūr town on 28 January, with the birds flying about and entering and leaving their holes.

Sp. No. 227 had a soft ovarian egg. The largest ovum in 228 was 3 mm. in diameter and its distended oviduct indicated that it had laid. Both these specimens were very fat. No. 236 (5 March), with testes 6×4 mm., was obviously also breeding. It was shot in the vicinity of the sandy bank of the Chenab River containing a number of holes occupied by the birds.

Hirundo rustica rustica Linn. The Common Swallow.

Specimens collected: 178 ♀ 23-2-39 Manthār (I); 229 ♂ 4-3-39 Jajjah-Abbāsiān (III-II).

Elsewhere noted: Bhūng (III-II).

[Measurements:

	Bill	Wing	Centr. Tail feathers	Outer tail feathers
1 ♀	12	124	44	104.5 mm.—H. W.]
1 ♂	—	121	42	107 mm.

Not abundant, but small numbers were frequently met with hawking insects about the *dhands,* cultivation, and along the larger canals.

The first meeting was not until 17 February after the Survey had been in the field for over 3 weeks.

Both the specimens were fat. In the male the first signs of gonadal development were discernible (2×1 mm.).

Motacilla alba dukhunensis Sykes. The White Wagtail.

Specimens collected: 11 ♂ 28-1-39 Bahāwalpūr town environs (III); 232 ♂ 5-3-39 Chāchrān (III).

Elsewhere noted: Hārūnābād (I).

[Measurements:

	Bill	Wing	Tail
2 ♂♂	16	89-92.5	86-87.5 mm.—H. W.]

Fairly common in the riverains of the Sutlej and Chenab, and also found sparingly about the canal colonies.

The specimen of 5 March was fat and evidently preparing to emigrate.

Motacilla alba personata Gould. The Masked Wagtail.

Specimen collected: 65 ♂ 6-2-39 Bahāwalpūr town environs (III).

[Measurements:

	Bill	Wing	Tail
1 ♂	18	94	93 mm.—H. W.]

This wagtail was observed in much smaller numbers than *dukhunensis,* also in the riverains of the Sutlej and Chenab rivers.

Motacilla flava subsp.? The Blue-headed Wagtail.

Several birds with a bluish-grey head—presumably *beema*—were seen on ploughed land bordering a *dhand* between Bahāwalnagar and Minchinābād (21 March).

Motacilla feldegg melanogriseus (Homeyer). The Turkestan Black-headed Wagtail.

Specimens collected: 171 o?, 17 o?, 173 o? 23-2-39 Manthār (I).

[Measurements:

	Bill	Wing	Tail
3 apparently 1st. year ♂♂	16-16.5	80-81	70-71.5 mm.—H. W.]

A flock of about 20 birds in a young vetch field, muddy and waterlogged by rain overnight. All the specimens in heavy moult.

Motacilla citreola calcaratus (Hodgs.). Hodgson's Yellow-headed Wagtail.

Specimen collected: 331 ♂ 22-3-39 Bahāwalnagar (III-II).

[Measurements:

	Bill	Wing	Tail
1 ♂	19.5	87	76—H. W.]

Several on the margin of a *dhand.*

Anthus trivialis haringtoni Witherby. Witherby's Tree-Pipit.

Specimens collected: 125 ♂ 16-2-39 Bhūng (III-II).

[Measurements:

	Bill	Wing	Tail
1 ♂	15	88	60 mm.—H. W.]

These birds appeared plentifully among gram fields and other cultivation on the morning of 16 February. Passage?

The testes of the specimen were beginning to enlarge. They measured 2×1 mm.

Anthus similis decaptus Meinertzhagen. The Persian Rock-Pipit.

Specimens collected: 123 ♀, 124 o? 16-2-39 Bhūng (III-II); 167 ♂ 22-2-39 Manthār (I); 223 ♂ 4-3-39 Jajjah-Abbāsiān (III-II); 250 ♀ 9-3-39 Lāl Sohāra (II) Elsewhere noted: Bahāwalpūr town environs (III)

[Measurements:

	Bill	Wing	Tail
2 ♂♂	20.5	103-104	83.5-91 mm.
2 ♀♀	20-23	98-101	86.5-87 mm.—H. W.]

Not uncommon. Single birds (almost invariably) were met with in among young gram and mustard crops, on fallow land about canal cultivation or on grassy canal banks. The specimens of 22 February and 9 March were very fat, the former having testes 4×2.5 mm. and the latter a coarsely granular ovary. In 223 (4 March) the testes measured 5×4 mm.

Anthus campestris griseus Nicoll. The Eastern Tawny Pipit.

Specimens collected: 24 ♂ 1-2-39 Bahāwalpūr town environs (III-II); 117 ♂, 118 ♀ 15-2-39 Bhūng (III-II); 174 ♂ 23-2-39 Manthār (I); 251 ♂ 9-3-39 Lāl Sohāra (II); 263 ♂, 264 ♂ 13-3-39 Hārūnābād (I).

[Measurements:

	Bill	Wing	Tail
6 ♂♂	17-18.5	90-94	68-77 mm.
1 ♀	17	88.5	70 mm.—H. W.]

Abundant in gram and vetch crops on sandy soil and in fallow fields of cotton, among the dry bare stalks. Specimens 263 and 264 (13 March) in freshly moulted summer plumage were bright yellow underneath and their gonads were beginning to develop. In either case the testes measured 2×1 mm.

Anthus roseatus Hodgs. Hodgson's Pipit.

Specimens collected: 242 ♂, 243 ♂ 6-3-39 Jajjah-Abbāsiān (III-II).

[Measurements:

	Bill	Wing	Tail
2 ♂♂	15-16	89-89.5	66.5-68 mm.—H. W.]

Several seen on a snipe marsh on the edge of a *dhand.* 242 had gonads 2×1 mm., while in 243 they were in a quiescent condition. The latter bird was fat.

Anthus spinoletta blakistonii Swinh. The Chinese Water-Pipit.

Specimens collected: 19 ♂ 2-2-39, 63 ♀ 5-2-39 Bahāwalpūr town environs (III); 108 ♂, 109 ♀ 14-2-39 Bhūng (III); 233 ♂ 5-3-39 Chāchrān (III).

[Measurements :

	Bill	Wing	Tail
3 ♂♂	16-17	92-93	66.5-68.5 mm.—H. W.]

Common. Was usually seen in loose scattered flocks on the wet grassy margins of *dhands,* and among mustard and other crops in the Indus and Chenab riverains.

This pipit utters a characteristic monosyllabic *si . . . si* &c. In freshly moulted summer plumage its vinous-grey and dark-streaked underparts are diagnostic in the field.

Alaemon alaudipes doriae (Salvadori). The Persian Desert-Lark.

Specimens collected: 97 ♂, 98 ♀ 10-2-39 Yazmān (I); 292 ♂ 16-3-39 Hārūnābād (I).

Elsewhere not noted.

[Measurements :

	Bill	Wing	Tail
2 ♂♂	33.5-34	136-139	94-97 mm.
1 ♀	28	120	81.5 mm.—H. W.]

A pair on the first occasion and a solitary example on the second represent my only meetings with the Desert-Lark in Bahāwalpūr State. It was found on extensive *pats* among the sand-dunes in pure desert facies, with a sparse sprinkling of *Suaeda* and *Salsola* bushes half buried in wind-swept sand. The birds had no others of their kind within a radius of at least 2 miles. Probably even in localities where they are commoner each pair inhabits a very wide stretch of country.

In general effect this Desert-Lark is remarkably midway between the Crested Lark (*Galerida cristata*) and the Cream-coloured Courser (*Cursorius cursor*). The black and white in the wings is conspicuous in flight. In life, and when freshly killed, the hind-crown is a delicate (almost pinkish) dove grey, as curiously enough it also is in the Cream-coloured Courser. This colour is lost in both species a few hours after death. In the china-white colouration of its legs and feet, in the colour and shape of its bill and in the black and white colour pattern in its wings, this lark bears a close similarity to the desert courser.

In specimen No. 97 (10 February) the testes had commenced enlarging (5×3 mm.). In 292 (16 March) they appeared to be mature (10×8 mm.). This bird was singing and displaying, and I feel almost certain that he had his mate (on eggs?) in the neighbourhood although owing to a dust storm in progress we failed to locate her. The male has a clear beautiful song of three mellow whistling notes *tee-tee-tee* followed by a prolonged note like that uttered by *Ammomanes phoenicurus* on the downward grade of its song flight. From the top of the bush on which it was perched the bird sprang about 5 feet up in the air every little while and nose-dived in the familiar manner of *Eremopterix,* at the same time singing and displaying the black and white of its wings and tail to greatest advantage.

Mr. R. C. Bolster found a nest of this Desert-Lark with c/3 on 18 April 1922 west of Dera Nawab, and has given a good description of it on p. 1132 of Vol. xxviii of the *Journal.*

It is a particularly fast runner, and I found to my cost both in Bahāwalpūr and previously in Sind that when merely winged it needs all-out sprinting to get level with the bird!

Alauda arvensis intermedia Swinhoe. The Transbaikal Skylark.

Specimens collected: 110 ♂, 111 ♀ 14-2-39 Bhūng (III).

[Measurements :

	Bill	Wing	Tail
1 ♂	15	115.5	70.5 mm.
1 ♀	14.5	108	67 mm.—H. W.]

Several observed in association with Water-Pipits in mustard fields on banks of the Indus. Gonads indicated the first beginnings of maturity. Testes 2×1 mm; ovary granular.

Alauda gulgula punjaubi Whistler. The Small Punjab Skylark.

Specimens collected: 99 ♂ 13-2-39 Bhūng (III-II); 139 ♂, 140 ♀ 18-2-39 Daulatpūr (III, Sukkur District frontier); 234 ♂ 5-3-39 Chāchrān (III).
Elsewhere noted: Bahāwalpūr town environs (III).

[Measurements :

	Bill	Wing	Tail
3 ♂♂	14-5-17	92.5-98	54-56 mm.
1 ♀	16	87.5	55 mm.—H. W.]

Common in the riverains of the great rivers, in and about wheat and vetch cultivation. Males soaring and singing aloft, often several together. By mid-February the birds had paired off. The specimens of 18 February had mature gonads and they were evidently breeding: testes 7×5 mm.; largest ovum 3 mm. diam. Testes of No. 234 (5 March) 5×4 mm.

Calandrella brachydactyla longipennis (Eversm.). The Yarkand Short-toed Lark.

Specimens collected: 93 ♂, 94 ♂, 95 ♀ 10-2-39 Yazmān (I); 132 ♀ 16-2-39 Bhūng (III-II); 179 ♂, 180 o?, 181 ♂ 25-2-39 Manthār (I); 241 ♂ 5-3-39 Chachrān (III); 296 o? 16-3-39 Hārūnābād (I).

[Measurements :

	Bill	Wing	Tail
7 ♂♂	13-14	92.5-100	59-62 mm.
2 ♀♀	13	92.5-94	55-57 mm.—H. W.]

Common and abundant. Often in large flocks on *pats* and fallow land about desert and semi-desert canal cultivation, and in the riverains.

A specimen of 25 February and another of 5 March were the only ones in which any departure from the absolute quiescent state of the gonads was discernible. In both cases the testes measured 2×1 mm. The last specimen—16 March—was very fat. and by that date also the flocks had coalesced into very large concentrations indicating that the birds were preparing to emigrate.

Calandrella rufescens persica (Sharpe). Sharpe's Sand-Lark.

Specimens collected: 34 ♀, 35 ♂ Bahāwalpūr town environs (II).

[Measurements :

	Bill	Wing	Tail
1 ♂	11	100	64 mm.
1 ♀	13	96	60 mm.

This form is doubtless often overlooked amongst the numbers of the last few. There are several Punjab records.—H. W.]

A flock of about 8 was seen feeding among sand-dunes with scanty bushes—typical *Sylvia nana* facies.

Calandrella raytal adamsi (Hume). The Indus Sand-Lark.

Specimens collected: 5 ♂, 6 o?, 7 ♂ 28-1-39, 64 ♂ 6-2-39 Bahāwalpūr town environs (III).

[Measurements :

	Bill	Wing	Tail
4 ♂♂	12.5-14	84.5-87	48.5-52 mm.—H. W.]

Abundant on the sandy beds of the Sutlej and the other large rivers, running about and feeding on the sand in twos and threes, or soaring and flying about aimlessly overhead. Also met with in the sandy environs of semi-desert canal cultivation. Two out of the 4 specimens were infested by endoparasitic worms—in the body cavity of one, and in the intestine of the other. The specimen of 6 February had testes 4×3 mm.

Galerida cristata chendoola (Frankl.). Franklin's Crested Lark.

Specimens collected: 9 ♂ 28-1-39, 21 ♂ 29-1-39 Bahāwalpūr town environs (III-II); 100 ♀ 13-2-39 Bhūng (III-II); 293 ♀, 294 ♂, 295 ♂ 16-3-39 Hārūnābād (I).

[Measurements:

	Bill	Wing	Tail
4 ♂♂	19-20	102-104	56-63 mm.—H. W.]

Common and abundant on dry sandy soil in the riverain, and also about semi-desert canal cultivation. In song and evidently breeding by mid-March. In No. 293 (16 March) the largest ovum measured 6 mm. diam. but the bird had evidently not commenced laying. In both Nos. 294 and 295 the testes were 10×6 mm.

Ammomanes deserti phoenicuroides (Blyth). The Indian Desert Finch-Lark.

Specimens collected: 44 ♀, 45 o? 3-2-39 Bahāwalpūr town environs (II); 149 ♀, 150 ♂ 151 ♀ 21-2-39, 185 ♂ 25-2-39, 194 ♂ 27-2-39 Manthār (I).

[Measurements:

	Bill	Wing	Tail
3 ♂♂	15-16	98.5-107	65-70 mm.
3 ♀♀	15-15.5	96-101	62-66 mm.—H. W.]

Common on *pats* in desert, and on fallow land in semi-desert canal cultivation, in twos and threes or loose flocks of up to 20. I found them drinking at a puddle regularly (on 3 successive mornings) at about 9-30 not in flocks like sandgrouse but in irregular relays of two or three at a time. Whether these larks also have fixed drinking times or drink at all hours of the day I was unable to ascertain.

The only departure from non-breeding condition of the gonads was noted in No. 150; testes 4×3 mm.

Eremopterix grisea siccata Ticeh. The Black-bellied Finch-Lark.

Specimens collected: 114 ♂ 14-2-39, 138 ♀ 17-2-39 Bhūng (III-II). Elsewhere noted: Bahāwalpūr town environs (III-II).

[Measurements:

	Bill	Wing	Tail
1 ♂	12	77	42 mm.
1 ♀	12.5	77.5	41 mm.—H. W.]

Rather uncommon and patchily distributed. It was met with on sandy fallow land in riverain cultivation, usually on more hard-crusted soil than that preferred by *Galerida cristata*. Testes 3×2, largest ovum 2 mm.

Eremopterix albifrons affinis (Blyth). The Indian Black-crowned Finch-Lark.

Specimens collected: 279 ♂, 280 ♂ 14-3-39 Hārūnābād (I). Not noted elsewhere.

[Measurements:

	Bill	Wing	Tail
2 ♂♂	12	82	50-51 mm.—H. W.]

A party of 5 or 6 (of both sexes) in a fallow field. Testes of both 4×3 mm.

Zosterops palpebrosa occidentis Ticeh. The N.-W. Indian White-eye.

Specimens collected: 284 ♂, 285 ♂ 14-3-39 Hārūnābād (I).
Elsewhere noted: Bhūng (III-II); Chāchrān (III).

[Measurements:

	Bill	Wing	Tail
2 ♂♂	12.5	55-56	38-39 mm.—. H. W.]

Uncommon. The specimens were shot among some shisham (*Dalbergia*) trees in the compound of the Inspection Bungalow. They were in association with *Remiz coronatus* and *Phylloscopus c. tristis.*

The White-eye furnishes a good example of a sedentary and thoroughly arboreal bird of wooded country and gardens creeping in to what was until quite recently pure desert, consequent upon suitable conditions produced by canal irrigation. It is more than likely that the birds breed here now. The testes of both the examples were enlarging. They measured 3×2 mm.; No. 285 was very fat.

Cinnyris asiatica brevirostris (Blanf.). The Sind Purple Sunbird.

Specimen collected: 287 ♂ 14-3-39 Hārūnābād (I).

Elsewhere noted: Jajjah-Abbāsiān (III-II); Chāchrān (III); Bahāwalnagar (III-II).

[Measurements:

	Bill	Wing	Tail
1 ♂	19.5	57	38 mm.—H. W.]

Between 27 January and 4 March this species appeared to be completely absent. The first example—a single male in breeding plumage—was observed on the latter date. At Hārūnābād only one other individual besides the specimen was noted, also in full summer dress. None at all were present on the *Calotropis* flowers, so beloved of the species, which were out in profusion about the canal cultivation in this locality. In the third week of March (Bahāwalnagar) it was less scarce than heretofore, though still only occasional and singly. Curiously enough all the individuals seen during the survey were males and in full summer dress. Not till the third week in March, however, were they heard in song. The Purple Sunbird is no doubt a local migrant as it is in Upper Sind, and likewise absent also from Bahāwalpūr during winter. The Survey records presumably represent return arrivals for the hot weather and breeding.

Dryobates scindeanus (Horsf. and Moore). The Sind Pied Woodpecker.

Specimens collected: 70 ♀, 71 ♀ 7-2-39 Bahāwalpūr town environs (III-II); 144 ♀ 18-2-39 Daulatpur (III, Sukkur District frontier); 169 ♂, 170 ♀ 23-2-39 Manthār (I).

Elsewhere noted: Bhūng (III-II); Bahāwalnagar (III-II).

[Measurements:

	Bill	Wing	Tail
1 ♂	28	116	71 mm.
4 ♀♀	24-26	111-115	65-70 mm.

This name would seem to be antedated by *Dryobates assimilis* Blyth. See Ticehurst *J.B.N.H.S.*, xxxiv, p. 468.—H. W.]

Not uncommon. A couple or so usually present in shisham plantations and tamarisk jungle growing both in the riverain and on seasonally inundated land by canals. At Manthār one such tamarisk jungle stood right in the midst of sand-dunes, and the specimens were secured in this. Where trees are scarce I have observed these woodpeckers clinging to the thin stems of tamarisk bushes and once even to a stake near a cultivator's hut used for tethering his cattle. The specimens of 23 February were beginning to show gonadal development: testes 3×2 mm., ovary coarsely granular.

Brachypternus benghalensis ssp. The Golden-backed Woodpecker.

Specimen collected: 231 ♂ 5-3-39 Chāchrān (III).
Elsewhere noted: Bhung (III-II); Jajjah-Abbāsiān (III-II); Hārūnābād (I).

[Measurements:

	Bill	Wing	Tail
1 ♂	41.5	146.5	87 mm.

This specimen is an intermediate between *benghalensis* and *dilutus* agreeing with the birds that one finds throughout the Western Punjab.—H. W.]

Not common. Occasional pairs in roadside babool trees, date groves along canals and shisham trees planted about villages and in Inspection Bungalow compounds. Testes of the specimen measured 10×6 mm.

Iynx torquilla torquilla Linn. The European Wryneck.

Specimens collected: 175 ♀ 23-2-39 Manthār (I); 317 ♂ 20-3-39 Bahāwalnagar (III-II).

[Measurements:

	Bill	Wing	Tail
1 ♂	17.5	90	68.5 mm.
1 ♀	18	92	72 mm.—H. W.]

The only two examples met with in Bahāwalpūr State. No. 175 was feeding on the ground like a finch, the other on a low branch in a shisham plantation.

No Barbets were heard or seen in Bahāwalpūr territory between end January and end March.

Centropus sinensis sinensis (Stephen). The Common Crow-Pheasant or Coucal.

Specimen collected: 206 ♀ 2-3-39 Jajjah-Abbāsiān (III-II).
Elsewhere noted: Bahāwalpūr town environs; Bahāwalnagar (III-II).

[Measurements:

	Bill	Wing	Tail
1 ♀	45	239	284 mm.—H. W.]

Uncommon. Single birds were occasionally met with chiefly in III. Several examples were seen amongst the partially submerged tamarisk thickets in Gagree *dhand* where the specimen was obtained.

The bird was found caught in a fish hook, one of many suspended by the local fishermen from a rope stretched a few inches above the surface of the water across a narrow inlet in the *dhand*. It had evidently perched on the rope, pulled up the line and swallowed the bait together with the hook, the point of which had pierced the gullet and was sticking outside. The stomach of this specimen contained exclusively remains of small fish such as those with which the hooks were baited, and the fish no doubt were the main attraction to the crow-pheasants here. I do not remember to have seen the fish-eating propensities of the crow-pheasant recorded before.

Psittacula eupatria nipalensis (Hodgs.). The Large Indian Paroquet.

Specimens collected: 76 ♀, 77 ♂ 7-2-39 Bahāwalpūr town environs (III-II).
Elsewhere noted: Daulatpur (Sukkur Dist. frontier, III); Jajjah-Abbāsiān (III-II); Bahāwalnagar (III-II).

[Measurements:

	Bill from cere	Wing	Tail	
1 ♂	38	230	353	19 mm.
1 ♀	33	221	325	19 mm.—H. W.]

The Large Paroquet was common and plentiful in Bahāwalpūr town and its immediate environs, but scarce elsewhere. To Yazmān and Manthār it does not as yet seem to have penetrated, no doubt owing to the absence of

suitable trees. Or it may be that it visits these localities after the breeding season is over when tree-holes are no longer an indispensable requisite.

In Bahāwalpūr town breeding was noted in full swing between end January and mid February. Holes in the trunks of *Albizzia lebbek* and *Tamarix gallica* trees were in general occupation by the birds. 3 or 4 holes close to one another in the trunk of a large *Albizzia* tree in the Prime Minister's garden were tenanted by as many pairs.

The gonads of the specimens were in breeding condition: testes 22×16 mm., largest ovarian follicle 6 mm. diam. with oviduct distended.

Psittacula krameri manillensis (Bechst.). The Rose-ringed Paroquet.

Specimens not collected.

Noted: Bahāwalpūr town, Daulatpūr, Jajjah-Abbāsiān, Hārūnābād, Bahāwalnagar.

Except in and about Bahāwalpūr town, where the numbers of the two species are about equal, this paroquet is commoner in the State than its larger relative. In the tamarisk jungles about the *dhands* at Jajjah-Abbāsiān (1-7 March) pairs were observed occupying all available holes, and breeding was in progress. This paroquet seems to have established itself in the Hārūnābād canal colony by this time.

Coracias benghalensis benghalensis Linn. The Indian Roller.

Specimen collected: 200 ♀ 1-3-39 Jajja-Abbāsiān (III-II),

Elsewhere noted: Bahāwalpūr town and environs (III-II); Bhūng (III-II), Hārūnābād (I), Bahāwalnagar (III-II).

[Measurements :

	Bill	Wing	Tail
1 ♀	44	188	126.5 mm.—H. W.]

The Roller was found in small numbers, usually singly, about cultivation. The specimen was a sickly emaciated bird and killed with a stick by a mohana (boatman). No outward injury was apparent. Its plumage was in perfect condition and ectoparasites were completely absent. At Bahāwalnagar, a locality in which the species was commoner than elsewhere, competition for tree holes and the noisy aerobatic displays, indicative of imminent breeding, were noted in progress between 21 and 24 March.

Merops orientalis orientalis Lath. The Common Indian Bee-eater.

Specimen collected: 36 ♂ 2-2-39 Bahāwalpūr town environs (III-II).

Elsewhere noted: Bahāwalpūr town (III), Bhūng (III-II), Manthār (I), Jajjah-Abbāsiān (III-II). Hārūnābād (I), Bahāwalnagar (III-II).

[Measurements :

	Bill	Wing	Tail
1 ♂	31	92.5	126.6 mm.—H. W.]

Evidently a migrant and absent from the area in winter. None were observed in Bahāwalpūr town and environs between 27 January and 2 February. The specimen (2 Feb.) was the first encountered; it was fat and there were only two other individuals with it. Their increase thereafter from day to day was marked, and when Bahāwalpūr town was re-visited on 10 March the species was found to have become quite common. It was then busy excavating nest tunnels in sand mounds, earth banks etc. as was also the case at Hārūnābād on 12 March and onwards.

In other portions of the State it was likewise noted as much scarcer at the beginning of the Survey than towards the end, by which time most birds had evidently returned to their breeding grounds.

Ceryle rudis [leucomelanura Reichenb.]. The Indian Pied Kingfisher.

No specimen collected.

Noted: Bahāwalpūr town environs (III-II), Manthār (I), Jajjah-Abbāsiān (III-II).

Fairly common on *dhands* and about the rivers and larger canals. At Manthār one was observed on a canal through pure sandy desert.

Alcedo atthis pallasi Reichenb. The Central Asian Kingfisher.

Specimen collected: 201 ♀ 1-3-39 Jajjah-Abbāsiān (III-II).
Elsewhere noted: Manthār (I).

[Measurements:

	Bill	Wing	Tail
1 ♀	43·5	77·5	37 mm.

This is one of those indefinite specimens whose identity it is impossible to establish satisfactorily, but it seems most likely to be this.—H. W.]

Not common. Occasional solos at *dhands* and canals—once on one through pure desert!

Halcyon smyrnensis [**smyrnensis** (Linn.)]. The White-breasted Kingfisher.

No specimen collected.

Noted: Bahāwalpūr town and environs (III-II), Manthār (I), Jajjah-Abbāsiān (III-II).

Not common. Occasional solos at *dhands,* rivers, canals and also about gardens and plantations. Once on a canal through pure desert country.

Upupa epops epops Linn. The European Hoopoe.

Specimens collected: 115 ♂ 14-2-39 Bhūng (III-II); 272 ♀ 13-3-39 Hārūnābād (I).

Elsewhere noted: Bahāwalpūr town and environs (III-II), Jajjah-Abbāsiān (III-II), Bahāwalnagar (III-II).

[Measurements:

	Bill	Wing	Tail
1 ♂	64	143	97·5 mm.
1 ♀	57	143·5	94·5 mm.—H. W.]

Not common but generally distributed in the riverain, and about canal cultivation in both the other tracts also. It loves to feed in and on the sides of dry sandy canals lined with date scrub and tall sarkan grass.

At Hārūnābād an example was observed flying about like mad in and out among the trunks of roadside shisham trees, crest and tail fully expanded, and turning and twisting in the air like a butterfly!

Both the specimens were very fat. Testes of No. 115 (14 Feb.) 3×2 mm.

Caprimulgus mahrattensis Sykes. Sykes's Nightjar.

Specimen collected: 168 ♀ 22-2-39 Manthār (I).
Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
1 ♀	19·5	170	99·5 mm.—H. W.]

The specimen—the only seen during the Survey—was obtained in a stretch of rolling sand-dunes, far out in the desert. At the report of the gun fired at a Desert Warbler it suddenly slithered at top speed half way down a bare sand-dune on the summit of which it had been lying under a half-buried *Capparis* bush, completely unnoticed and unsuspected: Ovary granular.

Otus bakkamœna. ssp. The Collared Scops Owl.

Specimens collected: 316 ♂ 19-3-39, 326 o? 22-3-39 Bahāwalnagar (III-II).
[Measurements:

	Bill	Wing	Tail
1 ♂	20	170	92 mm.
1 o?	22	177	87 mm.

I have compared these 2 specimens with a series of *O.b.gangeticus* and 3

specimens of *O.b.deserticolor* in the British Museum. If these two forms are really separable these specimens agree best with *gangeticus*, but there is a certain amount of individual variation in these small owls and I am not certain—on the material before me—that *gangeticus* and *deserticolor* are separable. If they are not, the name *deserticolor* of course takes precedence.—H. W.]

The Scops Owl was met with only at Bahāwalnagar where both the specimens were shot on different nights off the identical stump of a babool tree in the Inspection Bunglow compound. The birds advertised their presence soon after dusk by their mellow *wut . . . wut . . . wut* calls repeated monotonously every 5 seconds or so, sometimes for over 10 minutes at a stretch.

The testes of No. 316 had enlarged to 10×8 mm.

Bubo coromandus (or **bubo**). The Dusky (or Rock?) Horned Owl.

Heard at a distance in a shisham plantation on the Dera Nawab road (Bahāwalpūr town environs) on 7 February, and again at Bhūng on 19 February.

Athene brama indica (Frankl.). The Northern Spotted Owlet.

Specimens collected: 219 ♀ 3-3-39 Jajjah-Abbāsiān (III-II).
Elsewhere noted: Bahāwālpūr town environs, Bhūng.

[Measurements:

	Bill	Wing	Tail
1 ♀	20	165	82 mm.—H. W.]

Not uncommon, but less abundant than it usually is in most parts of continental or peninsular India. Hollows in ancient tamarisk trees near villages usually held a pair, and it was also partial to groves of date palms growing about the canals. My notebook records that its voice and notes sounded slightly sharper and different from those of the South Indian race *brama*. This same difference in voice I have noticed in the case of the northern and southern races of several other well known birds as well.

The specimen was preparing to lay shortly. It had a mature ovary with the largest follicle over 5 mm. in diameter.

Pandion haliaëtus haliaëtus (Linn.). The Osprey.

Specimen collected: 205 ♂ 2-3-39 Jajjah-Abbāsiān.

[Measurements:

	Bill	Wing	Tail
1 ♂	41	481	201 mm.—H. W.].

Shot at a *dhand* where this was the only example.

Torgos calvus (Scop.). The Black or King Vulture.

Noted only at Bahawalnagar, where it was uncommon.

Gyps fulvus ssp? The Griffon Vulture.

Several were observed at the remains of a carcase at Yazmān in pure desert on the outskirts of the canal colony (10 February).

Pseudogyps bengalensis (Gmelin). The White-backed Vulture.

Commonly nesting (end January) in large roadside shisham trees along the road from Lahore through Montgomery and Islam Headworks to Bahāwalpūr.

Neophron percnopterus [**percnopterus** (Linn.)]. The White Scavenger Vulture.

Noted in small numbers in Bahāwalpūr town environs, Yazmān, Manthār, Hārūnābād Bahāwalnagar and the intervening country, feeding on offal on the outskirts of villages and canal colony homesteads.

On 21 March a nest was nearing completion—both birds working—about 15 feet up in a babool tree close to a village between Bahāwalnagar and Minchinābād.

Falco peregrinus subsp.? The Peregrine Falcon.

No specimen.
Noted: Jajjah-Abbāsiān, Bahāwalpūr town environs.

One or two examples were usually to be seen in the vicinity of the duck-shooting *dhands*. One stooped on a wounded *Chettusia* struggling in the water, and so intense was its concentration upon the quarry that it stooped again and again regardless of 3 charges of dust shot at fairly close range which sent its feathers flying and blood could be seen on its underside. Another bird was observed to dive with lightning speed at an angle of 45° at a coot that had separated from its herd and to strike it in mid-air and bear it away, all in its stride.

Falco jugger J. E. Gray. The Laggar Falcon.

Specimens collected: 106 ♂, 107 ♀ 13-2-39 Bhūng (III-II).
Elsewhere noted: Hārūnābād (at edge of cultivation).

[Measurements:

	Bill	Wing	Tail
1 ♂	29	316	164 mm.
1 ♀	33	359	198 mm.—H. W.]

In these specimens—obviously a pair—the development of the gonads was much more advanced in the female than in the male. The testes measured only 10×6 mm. whereas the largest ovarian follicle was already over 4 mm. in diameter. Similar discrepancy in the maturity of the gonads of paired birds has been observed by me in several other instances before.

Falco tinnunculus tinnunculus (Linn.). The European Kestrel.

Specimens collected: 274 ♂ 14-3-39 Hārūnābād (I).
Elsewhere noted: Dera Bakha (II), Bhūng (III-II), Daulatpūr (III), Manthār (I).

[Measurements:

	Bill	Wing	Tail
1 ♂	20	258	173 mm.—H. W.]

Not common. Only occasional solos in semi-desert and in the vicinity of canal cultivation. The specimen, with testes 5×4 mm., was very fat.

Aquila rapax vindhiana Frankl. The Indian Tawny Eagle.

Specimen collected: 31 ♀ 1-2-39 Bahāwalpūr town environs (III-II).
Elsewhere noted. Bhūng.

[Measurements:

	Bill	Wing	Tail
1 ♀	55·5	534	258 mm.—H. W.]

Generally distributed but not abundant. The specimen was shot off a large stick platform nest at the top of a kikar tree (*Acacia arabica*) containing one hardest egg, unspotted greyish-white measuring 67×51 mm.

Aquila nipalensis nipalensis (Hodgs.). The Eastern Steppe Eagle.

No specimen.

Three examples were observed on the ground at Yazmān in semi-desert facies (10 Feby.).

Another large solitary eagle was seen on a canal bank at Manthār. It was blackish with a broad white subterminal band to the tail and grey patches under the wings visible in flight. As it was past dusk and the bird was very shy I did not get a satisfactory view, but as far as could be told it was not *Haliaëtus leucoryphus.*

Aquila clanga Pallas. The Greater Spotted Eagle.

Specimens collected: 203 ♂, 204 ♀ 2-3-39 Jajjah-Abbāsiān (III-II).

[Measurements :

	Bill	Wing	Tail
1 ♂	53	500	227
1 ♀	54	514	242 mm.—H. W.]

Several of these fine eagles were to be seen any day on the large duck-shooting *dhands* in the Jajjah-Abbāsiān area : Gagree, Tatar, Bakkūvāla and others.

Both the specimens were very fat. The stomach of one was empty ; the other contained a leg, bill and feathers of an adult tree-pie.

Hieraëtus fasciatus fasciatus (Vieill.). Bonelli's Eagle.

Specimens collected : 55 ♂, 56 ♀ 5-2-39 Bahāwalpūr town environs (Kāli *dhand*).

[Measurements :

	Bill	Wing	Tail
1 ♂	46	466	252 mm.
1 ♀	50	483	258 mm.—H. W.]

Presumably a pair since they were both in the same tree and no others of the species were about. Shot near a small *dhand* by the Sutlej river. Testes of ♂ (adult plumage) 17×12 mm. ; largest ovarian follicle of ♀ (sub-adult brown plumage) over 2 mm. in diam. At 9.30 a.m. the male's stomach was found to be empty ; the female's contained remains of a Grey Partridge, the leg with the spur being intact.

Haliaëtus leucoryphus (Pallas). Pallas's Fishing-Eagle.

Specimen collected : 202 ♂ 1-3-39 Jajjah-Abbāsiān (III-II).
Elsewhere noted: Bahāwalpūr town environs, at Kāli *dhand* and Sutlej river.

[Measurements :

	Bill	Wing	Tail
1 ♂	59.5	559	262 mm.—H. W.]

A pair or so usually present on *dhands* and the large rivers. Its loud screaming call is unmistakable. I liken it to the creaking on an unoiled wooden pulley of the water lifting gear at a village well. Coots seem to form an important item of its food. Its hunting tactics are to stampede a herd of coots and isolate an individual before it drives the attack home, stooping upon it as the bird patters along the surface of the water, and bearing it away in its claws.

A pair of these eagles had a nest ca. 40 ft. up in an old peepal tree near the Empress Bridge over the Sutlej (Bahāwalpūr town environs). The owners constantly kept to its proximity, but when climbed up to on 5 February it was found to be empty. The testes of the specimen measured 7×5 mm. and it was not clear if breeding was over or had not yet commenced.

Haliastur indus indus (Boddaert). The Brahminy Kite.

No specimen.
Noted : Bahāwalpūr town environs, Bhūng, Daulatpūr, Jajjah-Abbāsiān.
Fairly common by the large rivers and about *dhands* in the riverain tract.

Milvus migrans govinda Sykes. The Common Pariah Kite.

No specimen.
Noted : Bahāwalpūr town and environs, Dera Nawab, Bhūng, Jajjah-Abbāsiān, Hārūnābād and elsewhere.

Common in and about towns and villages. Breeding was in full swing throughout the duration of the Survey and many nests were observed in shisham trees with the birds brooding. As late as 4 March two pairs were noted in copula.

Elanus coeruleus vociferus (Lath.). The Black-winged Kite.

Specimen collected: 119 ♂ 15-2-39 Bhūng (III-II).
Elsewhere noted: Jajjah-Abbāsiān (III-II).
Only two examples seen during the entire Survey. In tamarisk and kandi (*Prosopis*) riverain jungle with clumps of tall coarse *sar* grass.

Circus macrourus (S. G. Gmelin). The Pale Harrier.

No specimen.
Rare. One or two noted at Yazmān, Bhūng and Hārūnābād about the wheat crops, but owing to possible confusion with *pygargus* these records should be taken with reserve.

Circus æruginosus æruginosus (Linn.). The Marsh Harrier.

No specimen.
Noted: Bahāwalpūr town environs, Manthār, Jajjah-Abbāsiān.
Not common but one or two frequently present about *dhands* and occasionally also canals. The Marsh Harrier was most in evidence at the various duck-shooting *dhands* at Jajjah-Abbasian. One was observed persistently harrying a moorhen (*Gallinula*), pouncing upon it repeatedly from the air into the reeds.

Buteo rufinus rufinus (Cretzschmar). The Long-legged Buzzard.

Specimen collected: 73 ♂ 7-2-39 Bahāwalpūr town environs (III-II).
Elsewhere noted: Bhūng (III-II), Jajjah-Abbāsiān (III-II).

[Measurements:

	Bill	Wing	Tail
1 ♂	42.5	412	224 mm.—H. W.]

Fairly common and frequent. Usually met with singly near canals and cultivation. Once far out amongst desert sand-dunes.

Butastur teesa (Frankl.). The White-eyed Buzzard-Eagle.

No specimen.
Noted: Bhūng and environs, Jajjah-Abbāsiān, Lāl Sohāra.
Not common. Occasional solos by cultivation and in the surrounding semi-desert.

Astur badius cenchroides Severtzof. The Sind Shikra.

Specimen collected: 261 ♀ 13-3-39 Hārūnābād (I).
Elsewhere noted: Bhūng (III-II), Bahāwalnagar (III-II).

[Measurements:

	Bill	Wing	Tail
1 ♀	22	218	174 mm.

This is one of those specimens which it is difficult to be certain about and the plumage is not paler than some specimens of *dussumieri*, but I identify it as *cenchroides* on the large wing which I cannot equal with a large series of *dussumieri*.—H. W.]

Uncommon. Met with singly in fruit gardens and shisham plantations about cultivation. The specimen had coarsely granular ovary with the largest follicle 2 mm. in diam. so it was evidently preparing to breed shortly.

Astur gentilis subsp.? The Goshawk.

Among the falcons kept by zamindar Sardar Khan of Daulatpur I saw a female Goshawk said to have been captured locally. It is said to be a rather scarce winter visitor to these parts. This statement was confirmed soon afterwards by 2 solos (or the same bird?) seen on 20 and 22 March in the environs of Bahāwalnagar. One of these made an unsuccessful stoop on a flock of Jungle Babblers.

According to the zamindar's falconer the colour of the female Goshawk's iris which is lemon yellow at 3 years age, changes to 'red' when the bird reaches 7 or 8 years.

Pernis ptilorhynchus ruficollis Lesson. The Indian Crested Honey-Buzzard.

Specimen collected: 72 ♀ 7-2-39 Bahāwalpūr town environs (III-II).
Elsewhere noted: Bahāwalnagar (III-II).

[Measurements:

	Bill	Wing	Tail
1 ♀	44	425	263 mm.—H. W.]

Rare. Solos met with in shisham plantations on two occasions only. Ovary of specimen coarsely granular.

Columba livia neglecta Hume. Hume's Blue Rock Pigeon.

Specimens collected: 299 ♂, 300 ♀ 16-3-39 Hārūnābād (I).
Elsewhere noted: Yazmān (I), Jajjah-Abbāsiān (III-II).

[Measurements:

	Bill	Wing	Tail
1 ♂	25	231	120 mm.
1 ♀	24.5	214	110 mm.—H.W.]

Flocks—sometimes of up to 50 or more—gleaning in harvested or newly sown fields. At Jajjah a colony roosted amongst a grove of date palms along a dry canal. The specimens were breeding: testes 21×10 mm.; largest ovum 10 mm.; oviduct greatly distended.

Columba eversmanni Bonaparte. The Eastern Stock-Pigeon.

Specimens collected: 301 ♂, 302 ♂ 17-3-39 Hārūnābād (I).
Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
2 ♂♂	21.5-22	201-211	98-105 mm.—H. W.]

A grove of babool trees standing amidst wheat fields was the roost of a colony of 100-200 of these pigeons. Parties and flocks flighted in every evening to this spot from the surrounding cultivation, and provided excellent sport. They are fast fliers and when thoroughly disturbed they turn and twist in the air with great agility offering a variety of shots. In fading light when silhouetted against the sky it is possible to confuse this species with the Ring-Dove, but the relatively shorter tail of the pigeon is always diagnostic.

The gonads of the specimens showed only a slight departure from the quiescent state. They measured 10×4 and 7×3 mm. respectively.

Streptopelia senegalensis cambayensis (Gmelin). The Little Brown Dove.

No specimen.

Noted: Bahāwalpūr town and environs (III-II), Bhūng (III-II), Manthār (I), Jajjah-Abbāsiān (III-II), Hārūnābād (I), Bahāwalnagar (III-I).

Common. Usually in the same semi-desert canal cultivation facies as the Ring-Dove. On 20 March one was observed carrying nesting material.

Streptopelia decaocto decaocto Frivalszky. The Ring-Dove.

Specimens collected: 176 ♂, 177 ♀ 23-2-39 Manthār (I)
Elsewhere noted: Bahāwalpūr town and environs (III-II), Yazmān (I), Bhūng (III-II), Jajjah-Abbāsiān (III-II), Hārūnābād (I), Bahāwalnagar (III-II).

[Measurements:

	Bill	Wing	Tail
1 ♂	22	160	117 mm.
1 ♀	21	168	125 mm—H. W.]

Common in the desert and semi-desert canal colonies. At Yazmān it was the only dove species, but in the other localities usually side by side with the Little Brown Dove. The gonads of the specimens gave no indication of breeding,

but on 20 March (Bahāwalnagar) a nest was found 12 ft. up in a babool tree with the bird brooding.

The Spotted Dove (*Streptopelia chinensis suratensis*), which inhabits more wooded country, was not met with in Bahāwalpūr State at all.

Œnopopelia tranquebarica tranquebarica (Herm.). The Indian Red Turtle Dove.

No specimen.

Uncommon. Only observed in the environs of Bahāwalpūr town (28 January).

Pterocles orientalis (Linn.). The Large Imperial, or Black-bellied Sandgrouse.

Specimens collected: 41 ♂ 2-2-39 Bahāwalpūr town environs (II); 54 ♂ 4-2-39 Dera Bakha (II).

Elsewhere noted: Yazmān (I), Manthār (I).

[Measurements:

	Bill	Wing	Tail
2 ♂♂	20-21	235-236	99-100 mm.—H. W.]

A fairly common and well-known winter visitor to Bahāwalpūr. Flocks of 20 to 40 and occasionally larger, usually seen on fallow fields about desert and semi-desert canal cultivation. Smaller parties were also met with on *pats* far out in the interior of the desert. Very wary. In flight the large size, black belly and white underside of wings are diagnostic of this species.

The specimen of 4 February was very fat. After 26 February the birds were not seen again, and by that date the majority had evidently left.

Pterocles alchata [caudacutus (Gmelin)]. The Large Pintail Sandgrouse.

A specimen was shot at Yazmān (10 February), but the shikari in his zeal had not only all but severed the neck in the name of Allah, but plucked off handfuls of its feathers before I could intervene!

Several small flocks of this sandgrouse were observed on *pats* and fallow fields in semi-desert in this locality but not elsewhere, so it is evidently an uncommon species.

Pterocles exustus ellioti Bogdanov. The Common Indian Sandgrouse.

Specimens collected: 159 ♂, 160 ♀, 161 ♂, 162 ♂ 22-2-39, 188 ♂ 26-2-39 Manthār (I).

Elsewhere noted: Bahāwalpūr town environs (II).

[Measurements:

	Bill	Wing	Tail
4 ♂♂	18.5-20	179-185	108-142 mm.
1 ♀	18.5	171	103 mm.—H. W.]

This sandgrouse seems to be much less common in Bahāwalpūr State than the Imperial. Beyond occasional small parties of from 3 to 12 in the localities mentioned, it was not met with.

Pterocles senegallus (Linn.). The Spotted Sandgrouse.

Speciment collected: 91 ♂ 10-2-39 Yazmān (I).

[Measurements:

	Bill	Wing	Tail
1 ♂	18	195	130 mm.—H. W.]

Several small flocks were observed on *pats* on the outskirts of canal cultivation in this locality.

R. C. Bolster (*J.B.N.H.S.*, xxvii, 807) records the Spotted Sandgrouse breeding 10 miles west of Ahmadpur East in 1922 (?). On 7 April he found 2 downy chicks a few days old, and remarks that one of them who distinctly larger than the other. As brooding in the open scrapes in sand in which the sandgrouse lay their eggs must necessarily begin with the first egg in order that it may not get baked by the fierce desert sun, this discrepancy in the age and size of the chicks is not what one would expect.

Coturnix coturnix coturnix (Linn.). The Common or Grey Quail.

Specimen collected : 187 ♀ 26-2-39 Manthār (I)
Elsewhere noted : Bhūng (III-II)

[Measurements :

	Bill	Wing	Tail
1 ♀	15.5	107	36 mm.—H. W.]

The Survey found the Grey Quail scarce. It may be more plentiful when on actual passage in spring and autumn. Occasional pairs or loose parties of 3 or 4 birds were flushed in young gram and wheat fields.

Francolinus francolinus henrici Bonap. The South Persian Black Partridge.

Specimens collected : 157 ♂ 21-2-39 Manthār (I)
Elsewhere noted : Bahāwalpūr town environs (III), Bhūng (III-II)

[Measurements :

	Bill	Wing	Tail
1 ♂	25	163	94 mm.—H. W.]

Frequents tamarisk scrub and tall *sarkan* grass patches in the riverain tract and by *dhands* and canals. Not abundant now and steadily growing scarcer. Almost completely wiped out from certain localities.

From what I gathered, this species and the Grey Partridge are very largely netted in Bahāwalpūr by professional bird catchers although of late the shikar department has been making an effort to check the ravages. For a recent official shooting camp and for the banquetting of high and mighty State guests I was informed that each of several tahsildars had orders to supply 500 birds. It is not difficult to conceive that many more birds must actually be captured for the required number to filter through to the other end! Thus extermination proceeds apace and unless stringent protection is enforced and professional snaring and netting completely banned—and that without delay—it is not improbable that soon partridges may have to be looked for in vain.

Francolinus pondicerianus interpositus Hartert. - The Northern Grey Partridge.

No specimen preserved.

Noted : Bahāwalpūr town environs (III-II), Yazmān (I), Bhūng (III-II), Hārūnābād (I) and elsewhere.

More abundant than the Black Partridge but equally persecuted. Frequents riverain cultivation as well as canal colonies in desert and semi-desert.

Rallus aquaticus korejewi Sarudny. The Turkestan Water-Rail

Specimens collected : 244 ♂, 245 ♂ 6-3-39 Jajjah-Abbāsiān (III-II).

[Measurements :

	Bill (from feathers)	Wing	Tail
2 ♂♂	41.5-42.5	121-122	49.5-53.5 mm.—H. W.]

Shot in a reed-bed bordering Gagree *dhand.*

Porzana pusilla pusilla (Pallas). The Eastern Baillon's Crake.

Specimens collected: 217 ♀ 3-3-39 Jajjah-Abbāsiān (III-II)

[Measurements :

	Bill (from feathers)	Wing	Tail
1 ♀	17	91	45 mm.—H. W.]

Shot in a reed-bed at Tatār *dhand.*

Amaurornis phoenicurus subsp.? The White-breasted Waterhen.

No specimen.
Noted on Baggah and Tatār *dhands,* Jajjah-Abbāsiān.

Photo : *Sálim Ali.*

A winged Houbara taking cover behind a diminutive bush.

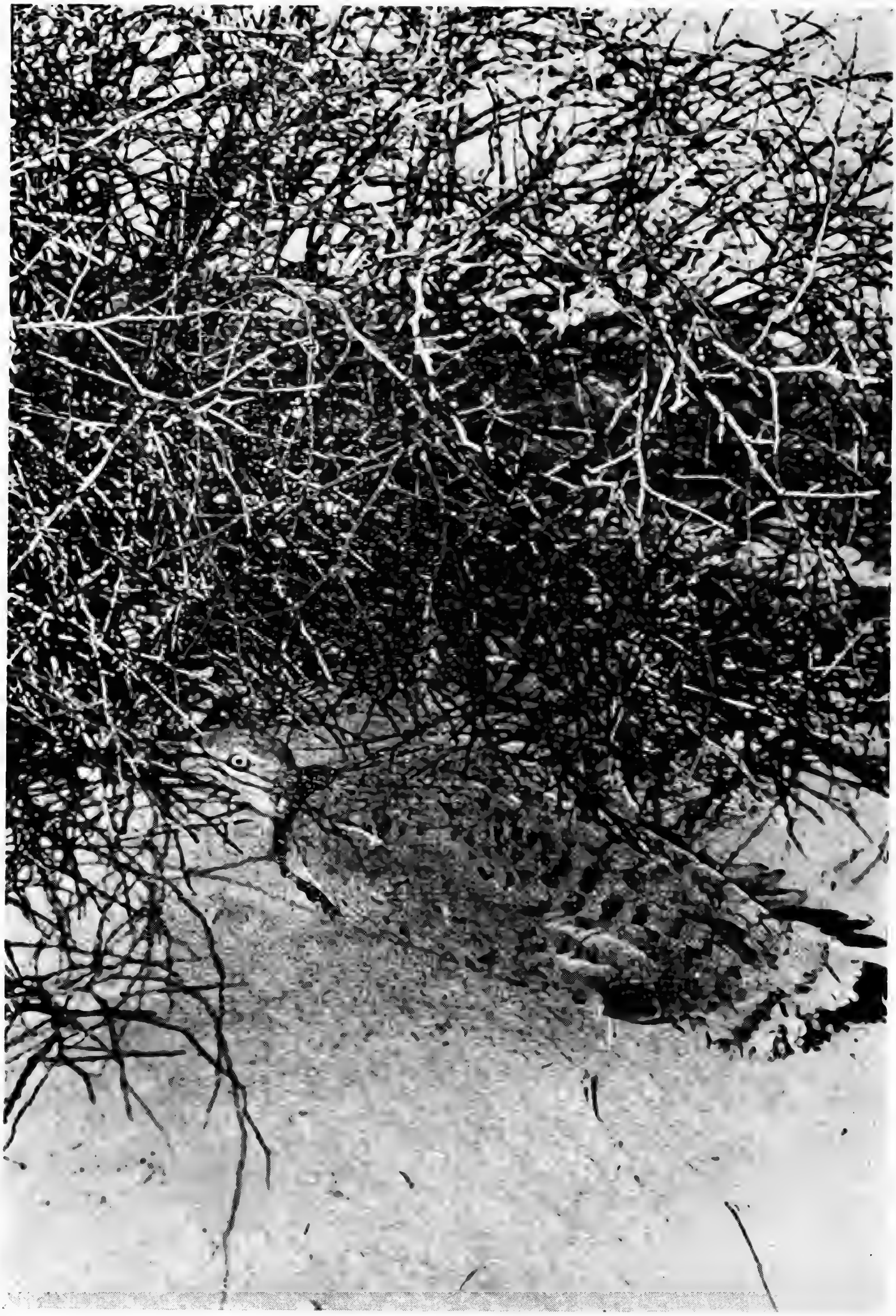

Photo : *Sálim Ali.*

The Houbara (*Chlamydotis undulata macqueeni*) when lying 'doggo' is a perfect example of obliterative desert colouration.

Gallinula chloropus subsp.? The Moorhen.

No specimen
Fairly common on Baggah, Tatār, Gagree and other *dhands* at Jajjah-Abbāsiān, and also at Bahāwalnagar.

Porphyrio poliocephalus subsp.? The Purple Moorhen.

No specimen.
Noted : Jajjah-Abbāsiān.

Common on Gagree and other *dhands* with reed-beds, on the edge of which it occasionally showed itself. It is much prized by the mohanas (boatmen) as food.

Fulica atra atra Linn. The Coot.

No specimens. Abundant on *dhands* at Jajjah-Abbāsiān, Bahāwalnagar and and elsewhere.

Anthropodes virgo (Linn.). The Demoiselle Crane.

No specimen. Noted at Yazmān (I), Chāchrān (III) and Hārūnābād (I).

Said to be unusually scarce this season (1938/39). Only small occasional flocks of 4 or 5 and up to 10 birds met with among young wheat fields in the riverain tract or canal cultivation in desert.

On 16 March on a loose sandy *pat* among low hummocky sand-dunes in the desert some 2 miles from the edge of cultivation, were observed recent foot-prints of an enormous congregation of some hundreds of large crane-like birds, possibly this species. Had they massed here prior to emigration?

Choriotes nigriceps (Vigors). The Great Indian Bustard.

No specimen. A pair was observed at Manthār on some abandoned fallow land bordering on sand-dune desert. The birds were excessively shy and difficult to approach even within fair rifle shot. Once on the wing, they flew steadily on for miles and were finally lost to view. Said to be rare in Bahāwalpūr.

Chlamydotis undulata macqueeni (Gray). The Houbara.

No specimen.
Noted: Bahāwalpūr town environs (III), Yazmān (I), Dera Bakha (II), Manthār(I)

Common and plentiful among the sandy mustard fields and low tamarisk scrub on the banks of the Sutlej river. Also in sparsely scrubbed desert and semi-desert country, often on the outskirts of cultivation especially of *sirsūn* (mustard) crops. Flocks of 4 to 7 birds were commonly met with.

The Houbara, at all times alert and swift on its legs, is well nigh unapproachable on a cool cloudy day. It is apparently not much hunted by the Punjabi settlers in the desert canal colonies, and it was difficult to find anybody with a proper idea of manoeuvring a camel round the bird in ever-narrowing circles as is the normal method of circumventing it in Sind. When pressed the Houbara surreptitiously lies 'doggo' behind a bush or mound, and it must be seen to be believed how thoroughly inconspicuous such a large bird can thus become in its sandy environment. In flight the white underparts and the round white patches near the wing tips are prominent. The flight, seemingly heavy with slow wing beats, head and neck extended as in the Stone-curlew, is in reality considerably swifter than it appears.

Cursorius cursor cursor (Lath.). The Cream-coloured Courser.

Specimens collected : 291 ♀ 15-3-39, 298 ♂ 16-3-39 Hārūnābād (I)
Elsewhere noted : Yazmān (I)

[Measurements :

	Bill	Wing	Tail
1 ♂	32	167	67 mm.
1 ♀	33	165	64 mm.—H. W.]

Patchily and locally distributed but apparently not uncommon in desert areas

on *pats* among sand-dunes, the facies common also to the Desert Lark (*Alaemon*). In colour scheme and general effect it is but an enlarged edition of the Desert Lark. In overhead flight the bird is strongly reminiscent of the Pratincole or Swallow Plover.

No. 291 was evidently ready to breed. Its largest ovarian follicle was over 3 mm. in diam. No. 298, less sexually mature (testes 6×4 mm.), was very fat.

Chettusia leucura (Licht.). The White-tailed Lapwing.

Specimens collected : 57 ♂, 58 ♂ 5-2-39 Bahāwalpūr town environs (III).
Elsewhere noted : Jajjah-Abbāsiān.

[Measurements :

	Bill	Wing	Tail
2 ♂♂	35-35·5	173-179	71-73 mm.—H. W.]

Not uncommon. Small flocks of 6 to 8 birds were usually met with on the marshy margins of *dhands*. The gonads of the specimens showed signs of enlargement. They measured 4×2 and 3×1.5 respectively.

Lobivanellus indicus subsp? The Red-wattled Lapwing.

No specimen.

Noted: Yazmān (I), Jajjah-Abbāsiān (III-II), Bahāwalpūr town environs (III-II).

Fairly common but not abundant. Pairs or small parties about irrigated ploughed and fallow land in semi-desert canal areas. Also at *dhands*.

The Yellow-watted Laping [*Lobipluvia malabarica* (Bodd.)] was not met with by the Survey between January and April. There is no information for other seasons of the year, but it is not unlikely that it may be a hot weather breeding visitor to Bahāwalpūr territory as it is in Sind and elsewhere.

Charadrius dubius jerdoni (Legge). Jerdon's Little-Ringed Plover.

Specimen collected : 8 ♂ 28-1-39 Bahāwalpūr town environs (III).
Elsewhere noted : Bahāwalnagar (subspecies?).

[Measurements :

	Bill	Wing	Tail
1 ♂	15·5	114	60 mm.—H. W.]

Not common. Small parties of 3 or 4 were occasionally seen on sandy river beds and at *dhands*. Left testis of specimen 6×3 mm., right 3×2 mm.

Tringa totanus eurhinus (Oberh.). The Redshank.

Specimens collected : 59 ♀, 60 ♂, 61 ♂, 62 ♀ 5-2-39 Bahāwalpūr town environs (III).
Elsewhere noted : Bhūng (III-II), Bahāwalnagar (III-II).

[Measurements :

	Bill	Wing	Tail
2 ♂♂	49-51	160-161	66-72 mm.
2 ♀♀	51-53·5	162-165	66.5-67 mm.

These birds belong to the grey eastern race for which I prefer to use the name *eurhinus* and not *terrignotae*. There has, however, been considerable controversy about the matter and for this consult *Ibis* 1934, p. 115, 1936 p. 826 and 1938 p. 525.—H. W.]

Redshanks were seen in large flocks of 40 to 50 each at *dhands* in the environs of Bahāwalpūr town. They were common here in early February. Elsewhere solitaries or small parties of 3 or 4 were met with. The last date recorded is 21 March, by which time most birds had certainly left. There was of course no development as such in the gonads of the specimens though in both sexes a slight departure from the absolute quiescent condition was discernible. The testes of No. 60 measured 3×1.5 mm.

All the birds were infested with flukes in the posterior body cavity. One had 28 of the parasites clinging in a mass to the ceiling of the lumbar region. Outwardly the birds appeared perfectly healthy, and they were in good condition.

Philomachus pugnax (Linn.). The Ruff and Reeve.

Specimen collected: 325 ♂ 21-3-39 Bahāwalnagar (III-II.)

[Measurements:

	Bill	Wing	Tail
1 ♂	43·5	181	69 mm.—H. W.]

One of a pair at a *dhand*. Testes 3×2 mm. Very fat.

Tringa ochropus Linn. The Green Sandpiper.

Fairly common at *dhands* and puddles.

Tringa glareola Linn. The Wood Sandpiper.

Noted at a *dhand* between Bahāwalnagar and Minchinābād.

Tringa hypoleucos Linn. The Common Sandpiper.

Not common. Noted singly on margins of *dhands*.

Glottis nebularia (Gunnerus). The Greenshank.

Noted Bhūng 16 February. Solo on a small open pond.

Erolia temminckii (Leisler). Temminck's Stint.

Noted: Bahāwalpūr town environs, Bhūng, Jajjah-Abbāsiān, Bahāwalnagar.

Fairly common on damp grassy margins of tanks whence the water has receded. In small parties of 3 or 4 and flocks of up to 20 individuals.

Capella gallinago gallinago (Linn.). The Common or Fantail Snipe.

Common. Shot around the *dhands* at Jajjah, Bahāwalnagar and elsewhere.

Lymnocryptes minima Brunnich. The Jack Snipe.

Fairly common. Shot at Jajjah-Abbāsiān.

Larus ridibundus (or **brunicephalus?**). The Black- (or Brown-?) headed Gull.

Two gulls in winter plumage were observed on Gagree *dhand* at Jajjah-Abbāsiān on 2 and 6 March. They were extremely wild and impossible to approach within gunshot.

Sterna aurantia Gray. The Indian River Tern.

Common on the larger rivers—Indus, Sutlej, Chenab.

Sterna melanogaster Temm. The Black-bellied Tern.

Noted in Bahāwalpūr town environs and near Bhūng, on the Sutlej and Indus rivers.

Phalacrocorax niger (Vieill.). The Little Cormorant.

Noted at Gagree *dhand*, Jajjah-Abbāsiān, 2-6 March.

Phalacrocorax carbo sinensis (Shaw & Nodder). The Indian Large Cormorant.

Fairly abundant on Gagree *dhand*, Jajjah-Abbāsiān, 2-6 March.

Phalacrocorax fuscicollis Stephen. The Indian Shag.

Several on Gagree *dhand*, Jajjah-Abbāsiān, 2-6 March.

Anhinga melanogaster Pennant. The Indian Darter or Snake-Bird.

Noted: Bahāwalpūr town environs, Jajjah-Abbāsiān, Bahāwalnagar. Common at *dhands*.

Ciconia nigra (Linn.). The Black Stork.

Noted only in Bahāwalpūr town environs in Sutlej river bed. Three on 28 January; solo 29 Jan.

Ardea purpurea (manillensis Meyen). The Eastern Purple Heron.

Two or 3 solos seen at Gagree *dhand*, Jajjah-Abbāsiān, 2 March.

Ardea cinerea subsp.? The Grey Heron.

Occasional solos observed at *dhands* in Bahāwalpūr town environs and at Jajjah.

Egretta alba subsp.? The Large Egret.

Noted: Bahāwalpūr town environs, Jajjah-Abbāsiān. Solos at *dhands*.

Egretta intermedia (Wagler). The Indian Smaller Egret.

Observed at Gagree *dhand*, Jajjah-Abbāsiān, 2-6 March.

Egretta garzetta (Linn.). The Little Egret.

Observed at Gagree *dhand*, Jajjah-Abbāsiān, 2-6 March.

Ardeola grayii (Sykes). The Indian Pond Heron.

Noted: Bhūng.
Apparently uncommon in Bahāwalpūr State.

Nycticorax nycticorax nycticorax (Linn.). The Night Heron.

Noted: Jajjah-Abbāsiān (Gagree *dhand*) 4 March.

Butorides striatus javanicus (Horsf.). The Indian Little Green Heron.

Specimen collected: 209 ♀ 2-3-39 Jajjah-Abbāsiān (III-II).

[Measurements:

	Bill (from feathers)	Wing	Tail
1 ♀	64	170.5	60 mm.—H. W.]

One of a pair amongst partially submerged tamarisk tangles in Gagree *dhand*.

Anas platyrhyncha Linn. The Mallard.

Evidently the most abundant wintering duck in Bahāwalpūr. Out of about 1000 duck killed during one of the big shoots at Jajjah-Abbāsiān between 26 and 29 January (1939) about 800, i.e. about 80% were Mallards. By the beginning of March most birds of this species had left.

Spatula clypeata Linn. The Shoveller.

Common on *dhands*, Jajjah, 2-6 March.

Anas streperus Linn. The Gadwall.

Common on *dhands*, Jajjah, 2-6 March.

Anas penelope Linn. The Wigeon.

Common on *dhands*, Jajjah, 2-6 March.

Dafila acuta (Linn.). The Pintail.

Fairly common on *dhands*, Bahāwalpūr town environs & Jajjah.

Nettion crecca (Linn.). The Common Teal.

Common on *dhands* everywhere.

Casarca ferruginea (Vroeg.). The Ruddy Sheldrake or Brahminy Duck.

A couple were observed on a mudbank in the Indus at Daulatpūr (Sukkur Dist. frontier) 18 February.

Netta rufina (Pallas). The Red-crested Pochard.

Common. By the end of the first week of March mostly this species, *Althya rufa* and *Nettion crecca* were left on the various *dhands* at Jajjah-Abbāsiān.

Marmaronetta angustirostris (Ménétriés). The Marbled Teal.

I examined 2 specimens killed during the big shoot at Jajjah between 26 and 29 Jan.

Aythya fuligula fuligula (Linn.). The Tufted Pochard.

Observed on Baggah and Tatār *dhands,* Jajjah-Abbāsiān, 2-6 March.

Aythya rufa rufa Linn. The White-eyed Pochard.

Common on *dhands* throughout the area. One of the last ducks to leave for their breeding grounds.

Podiceps nigricollis nigricollis Brehm. The Black-necked Grebe.

I examined a specimen killed during the big shoot at Jajjah between 26 and 29 January. No others were seen.

Podiceps ruficollis capensis (Salvadori). The Indian Little Grebe.

Specimens collected: 207 ♂, 208 ♂ 2-3-39 Jajjah-Abbāsiān (III-II).

[Measurements :

	Bill	Wing	Tail
2 ♂♂	26.5-27	99.5-102.5	27-34 mm.—H. W.]

Common and abundant on all *dhands.* No. 207 was very fat with testes 6×4 mm. Testes of 208 4×3 mm.

THE EARLY STAGES OF INDIAN *LEPIDOPTERA*.

BY

D. G. SEVASTOPULO, F.R.E.S.

PART VIII.

(*Continued from Vol.* xlii, *No.* 3 (1941), p. 517).

RHOPALOCERA.

PIERIDAE.

Delias berinda Moore, *berinda*.

Pupa looking very like a large bird dropping. Cephalic snout slightly bifid with the points upturned. Two small spines immediately above the eyes. Thorax slightly keeled. A series of very small dorsal tubercles decreasing in size towards the cremaster. A dentate ridge on the abdomen subdorsally above the edge of the wing case. Ground colour olive brown. The sides of the mesathorax, a triangular patch on the wing case, its apex, a lateral abdominal stripe, wider just before the cremaster, and a ventral stripe on the anterior portion of the abdomen white. A ventral stripe and the dorsum of the last two abdominal somites and the centre tooth of the ridge above the wing case black. A lateral tubercle on the mesathorax and the rest of the dentate ridge above the wing case yellowish. Suspended by a girdle and tail pad of white silk.

A number of pupae were found attached to rootlets under the over-hang of a bank beside a path through woods. One was found about six feet from the ground attached to a bamboo.

Described from a number of pupae found in Shillong, from one of which a male emerged 6-v-41.

NYMPHALIDAE.

Precis orithya L., *ocyale* Hbn.

de Nice., *Butt. Ind.*, ii, 73. 1886.
Moore, *Lep. Ceyl.*, i, 41, pl. 22, fig. 1b. 1881.
Moore, *Lep. Ind.*, iv, 69, pl. 311, figs. 1, 1a-1e. 1899-1900.
Bingham, *Fauna Brit. Ind.*, Butterflies, i, 358. 1905.

Head black, the clypeus filled in with orange, hairy and with each lobe ending above in a short branched spine. Body black, a paler double dorsal stripe, the area between sprinkled with white dots, a very broken yellowish lateral line from the 4th somite backward and a yellow subspiracular line. 1st somite with a pale orange collar. The lateral area with occasional minute white dots arranged in transverse lines. 1st somite with a short subdorsal black branched spine, a double sublateral branched spine, the upper deep yellow, the lower black. 2nd and 3rd somites with longer

subdorsal and lateral black branched spines and a double shorter sublateral one. 4th to 10th somites with dorsal, subdorsal and lateral black branched spines (five in all) and a double sublateral, the upper with a deep yellow base. 11th somite similar but with two dorsal spines, one before the other. 12th and 13th somites with subdorsal black spines only. Two small branched black spines at the base of each proleg. Legs black. Prolegs deep yellow banded with black. Venter blackish grey.

Pupa suspended by the cremaster. Shape rather short and stout, thorax hardly keeled. Colour dark brownish black, the dorsum with a series of small subdorsal tubercles marked with pale pinkish grey, and with a transverse pinkish grey band before the cremaster. Traces of a pinkish grey dorsal line. Wing cases more olive brown in colour.

Described from a full fed larva found in Shillong 24-iv-41, pupated 27-iv-41 and a female emerged 15-v-41.

Bingham, quoting de Niceville, writes:—'Larva head and body of a very dark shining black shading into brown . . . head on a short neck, latter of an orange colour for a short distance; caudal extremity also tipped with orange. Body covered with perpendicular spines armed with strong radial hairs . . . Head bifurcated, reddish spot in centre of face, a small spinous process in the angle of each eye. Pupa suspended by tail, naked; wing-covers of a muddy yellow; rest of body of a purplish colour variegated by lines of a dull creamy white. Slight projections of an angular nature along the abdomen.' Moore describes the Ceylon form, now known as ssp. *swinhoei* Btlr., as follows:—'Larva dark purple-brown, each somite with short branched spines, two lateral rows of small yellow spots. Pupa ochreous, speckled and lined with dark brown. Feeds on Acanthads.' His figure shews a black larva with a double lateral row of white elongated spots.

Vanessa cardui L.

Moore, *Lep. Ceyl.*, i, 50, pl. 27, fig. 1a. 1881.

Bingham, *Fauna Brit. Ind.*, Butterflies, i, 366. 1905.

Head black with short bristly pubescence. Body dull black clothed with short erect white hairs. An indistinct double yellow dorsal line, traces of a transverse yellow line intersegmentally and a broad yellow sublateral stripe. 1st somite with a minute subdorsal black tubercle and with a lateral and two sublateral yellow ones. 2nd and 3rd somites with a subdorsal, lateral and two sublateral short branched spines, pinkish basally and yellowish apically. 4th to 11th somites with similar spines dorsally, subdorsally and laterally (five in all) and two yellowish spines sublaterally. 12th and 13th somites with the subdorsal spines only. Legs and prolegs brown. Venter grey speckled with whitish.

Pupa suspended by the cremaster. Pale pinkish buff with a darker subdorsal and lateral stripe. Wing cases darker and mottled. A series of nine short stout golden spines subdorsally on thorax and abdomen. Traces of a gold tinged dorsal abdominal stripe, the keel of the thorax slightly golden. Shape, thorax slightly

keeled, wing cases slightly angled, head truncate, very slightly bifid.

Food-plant—Thistles.

Described from a full fed larva found in Shillong 8-v-41, pupated 12-v-41 and a male emerged 29-v-41.

Moore's description, which is quoted by Bingham, is 'Larva blackish-brown, with a longitudinal pale interrupted line on each side; the segments armed with short branched spines. Feeds on *Artemisia*. Pupa tuberculate head bluntly cleft, pale ochreous or brown, more or less spotted with yellow.' The figure shews a black larva with greyish intersegmental stripes.

Vanessa canace L., *canace.*

Bingham, *Fauna Brit. Ind.*, Butterflies, i, 372. 1905.

Head black, hairy, with an inverted reddish Y-shaped mark. 1st somite reddish spotted with black, rest of the body with a bright rust-red black-spotted transverse band across the centre of each somite, the intersegmental area black transversely lined with whitish. 1st somite spineless. 2nd and 3rd somites each with a subdorsal and lateral white branched spine, the apical branches black. 4th to 11th somites each with a similar dorsal, subdorsal, lateral and sublateral spine (seven in all). 12th and 13th somites each with a pair of subdorsal spines only. Anal plate black. Legs black. Prolegs black banded with rust-red. Venter black transversely lined with whitish.

The young larva is similar but the rust-red is replaced by bright cadmium yellow. The rust-red colour develops after the last ecdysis.

Pupa suspended by the cremaster. Colour dark purple brown mottled with darker and paler and varying considerably in depth. The abdomen with a pale dorsal line, a double pale ventral line and a pale lateral stripe from the edge of the wing case to the cremaster. Wing cases with a central triangular dark mark. Metathorax and 1st abdominal somite with paired subdorsal golden spots. 2nd and 3rd abdominal somites tinged with metallic copper colour. Shape longer than the usual Vanessid pupa. The head bifid and the cephalic horns long and curved inward. Thorax keeled. Wing cases angled. Abdomen with a series of seven subdorsal and five dorsal spines. Cremaster very long, the edges pale.

Food-plant—*Smilax*.

Described from a full fed larva found in Shillong 21-iv-41, pupated 25-iv-41 and a male emerged 11-v-41.

Bingham, quoting a description by Hampson, writes:—'Larva segments alternately orange and white, with numerous black spots on the orange segments and black streaks on the white; seven white, branching, black-tipped spines on each orange segment. Pupa variegated reddish brown, with frontal gold and silver spots; head produced and bifid.' Moore (*Lep. Ceyl.*, i, 49, pl. 25, fig. *2a*. 1881) describes and figures the larva and pupa of the Ceylon subspecies *haronica* Moore. The description is 'Larva light red, spotted wth black, the segments divided by black and purple lines, armed with eight longitudinal rows of delicate branched spines; anal

segment slightly humped. Feeds on *Smilax*. Pupa reddish-brown, abdominal segments tubercular, thorax angular, head produced and bifid.' He further mentions that the larva also feeds on Wild Yam. The figure shews a bright yellow larva spotted with black and with the intersegmental areas streaked with black and purplish. The pupa is too short and the shape of the cephalic horns is incorrect. Bingham quotes another very similar description from Moore (*Lep. Ind.*, iv, 94, pl. 315, fig. 2. 1899-1900) which gives the spines as yellow and mentions that the head and legs of the larva are black and that the pupa has two dorsal rows of small reddish pointed tubercles on the abdomen.

Argynnis hyperbius L., *hyperbius*

de Nice., *Butt. Ind.*, ii, 131. 1886.

Bingham, *Fauna Brit. Ind.*, Butterflies, i, 440. 1905.

Head dull black. Body velvety black with a broad dull orange dorsal stripe. 1st somite anteriorly with a long subdorsal and posteriorly with a shorter lateral black branched spine. 2nd somite similar. 3rd somite with the subdorsal spines only. 4th to 11th somites with a series of subdorsal, lateral and sublateral branched spines, the subdorsal series longest, those on the 4th somite black, on the others with the apical third black, the basal two-thirds pink. 12th somite with a subdorsal and a lateral pink and black spine. Legs black. Prolegs black, the feet yellow. Venter black.

Pupa dark blackish brown, the wing cases slightly mottled with paler. Dorsum with traces of a median stripe composed of chestnut specks, the thoracic keel chestnut. The thorax with three and the abdomen with two subdorsal golden spots. Shape head bifid and produced into two short horns, wing cases angled, thorax keeled. A small black spine in each of the thoracic and abdominal gold spots and a series of six subdorsal outwardly curved spines, of which the first is the largest. Suspended by the cremaster.

Food-plant—Garden Pansy.

Described from a full fed larva found in Shillong 5-v-41, pupated 8-v-41 and a male emerged 18-v-41.

Bingham quotes de Niceville as follows:—'Larva head and legs black; body black, this colour, however, obscured by orange-tawny markings. A broad orange-tawny dorsal stripe. Four straight horizontal simple black spines on head; spines on pectoral segments black; on abdominal segments pink tipped with black; on caudal segments pink faintly black-tipped. Pupa head and wing-cases pale Indian red; ten pale metallic spots on back; abdomen dark pink; spines faintly black-tipped. The head ends in two well-separated blunt points; there are a pair of spines anteriorly, another in the middle, and a third smallest pair posteriorly on the thorax, the latter being hunched and keeled, on the abdominal segments there are eight pairs of spines, the third anterior pair the largest.' Moore, in *Lep. Ceyl.*, i, pl. 31, fig. 2b. 1881, figures the larva and pupa of the Ceylon subspecies *taprobana* Moore, he gives no description but mentions Wild Violet as the food-plant. The figure shews a dull black larva with a dull tawny dorsal stripe. The shape of the pupa is not very accurate.

Cethosia biblis Drury, *tisamena* Fruhs.

Head black. Body with the intersegmental areas black, each somite with a transverse white, purple and white stripe, a black stripe dividing the colours. An interrupted sublateral white stripe. Lateral area and venter black. Legs and prolegs black, the feet of the latter grey. Spiracles black ringed with white. Head with a pair of long thin tuberculate black spines. 1st somite with an anterior subdorsal and a posterior lateral similar but shorter spine. 2nd somite with similar but slightly longer spines. 3rd somite with the subdorsal spine only, but rather longer. 4th to 11th somites with a subdorsal, lateral and sublateral spine. 12th somite with subdorsal and lateral only. On all the somites the subdorsal spine is longest, the sublateral shortest, and, except for the 1st and 2nd somites' lateral spines, all arise from the purple stripe.

Pupa suspended by the cremaster. Shape—head truncate and projecting laterally into a slightly upturned tubercle. Pro- and meso-thorax with a subdorsal spine, wing cases with two lateral projections above, abdomen with three pairs of subdorsal spines, then a rounded lobe terminating in a spine and then a further four spines decreasing in size from front to rear. A lateral series of four spines on the abdomen, the first fairly long, the fourth little more than a tubercle. A pupa formed in captivity was ivory white with a subdorsal and lateral series of small olive brown blotches. The wing cases also blotched centrally with olive brown. Cremaster black, last three abdominal somites marked with black dorsally and ventrally. A double dorsal golden spot on the prothorax and two on the anterior somites of the abdomen. A wild caught pupa of similar shape, which unfortunately died but was almost undoubtedly of this species, had a rich deep golden brown ground colour.

Food-plant—A small creeper with heart-shaped leaves. The larvae refused to eat the ordinary cultivated Passion Flower.

Described from a full fed larva found in Shillong 7-v-41, pupated 16-v-41 and a female emerged 23-v-41.

Pareba vesta F., *vesta*.

Moore, *Lep. Ind.*, v, 31, pl. 387, figs. 1, 1a-1f. 1901-03.

Bingham, *Fauna Brit. Ind.*, Butterflies, i, 470. 1905.

Head yellowish brown, a pale inverted Y-shaped mark, the arms filled in with black and edged with black externally. Ground colour of body creamy-white, a chocolate brown dorsal, lateral and sublateral stripe and with two transverse chocolate brown stripes across each somite posterior to the spines and another on the intersegmental area. Armed with the following slightly branched spines, basally yellow brown and apically black and arising from yellowish warts between the longitudinal stripes, 1st somite with a subdorsal spine, 2nd and 3rd with a subdorsal and lateral, 4th to 11th with a subdorsal, lateral and sublateral, and 12th somite with a subdorsal and lateral. Legs and prolegs black. Venter whitish with a purplish brown lateral stripe.

Pupa suspended by the cremaster. Shape long, not prominently angled, a series of short black spines subdorsally on thorax and abdomen. Colour white. Abdomen with a black subdorsal,

lateral and a median ventral stripe, the subdorsal and lateral bearing seven and four deep yellow spots respectively, the ventral with an interrupted yellow internal stripe. Wing cases veined with black. Thorax with a central yellow stripe edged with black. Antenna cases yellow outlined with black. Head and leg cases marked with black.

Described from a full fed larva found in Shillong 21-iv-41, pupated 25-iv-41 and a male emerged 14-v-41.

Bingham, quoting Moore, gives the following description:—'Larva elongated; head unarmed; segments armed with a subdorsal and a sublateral row of long, sharp-pointed, branched spines and a lateral row of shorter naked spines. Head reddish ochraceous, black-spotted, front with a white stripe; segments dark purplish violet, with longitudinal rows of short transverse white bars; spines ochreous with black tips; legs ochreous with black bands. Pupa suspended. Elongated, narrow; head with two short frontal points; thorax convex and uneven; abdominal segments with a dorsal and two lateral rows of short tubercular points. Colour white, tubercles and streaks on wing-cases ochreous.'

Lycaenidae.

Rapala nissa Koll., *rectivitta* Moore.

Head small, black and retractile. 1st somite hood-shaped. 2nd to 9th somite each with a subdorsal and sublateral fleshy tooth ending in a few black bristles. 10th somite with two sublateral teeth but no subdorsal. 11th somite with one sublateral tooth. Colour yellowish green with a darker dorsal line, the teeth somewhat paler and with an oblique triangular pale lateral mark on each somite. Legs, prolegs and venter paler green. Ant gland and tubercles inconspicuous.

Pupa of the usual Lycaenid shape. Pale pinkish grey, the sides of the thorax and wing cases suffused with blackish. Formed in captivity on a slight mat of silk on the bottom of the tin and covered by a leaf, and secured by a slight girdle and the cremaster.

Described from a full fed larva found in Shillong 21-iv-41, pupated 27-iv-41 and a female emerged 15-v-41.

HETEROCERA.

Lymantriidae.

Porthesia scintillans Wlk., *limbata* Btlr.

Head black. Ground colour of body black. A double orange-red dorsal line on the 1st to 3rd somite, the lines divide and become subdorsal on the 4th and 5th somites and then join again and continue dorsally very indistinctly to the 10th somite. 4th and 5th somites with small dorsal humps tufted with short black hair. 6th to 10th somites with round subdorsal patches of white scale-like hairs, 4th and 5th somites with smaller patches below

the dorsal humps. 11th somite slightly humped and with a few of the white scale-like hairs laterally. An orange-red sublateral line with a series of crimson warts bearing white hairs, the warts continuing across the 12th somite. 1st somite with red subdorsal tubercles tufted with blackish hairs. A few white hairs. Dorsal glands pale lilac. Legs and prolegs yellowish grey. Venter black streaked transversely with orange-red.

Cocoon of dark brown silk mixed with larval hairs. Pupa olive brown, the abdomen tinged posteriorly with yellow, the wing-cases with green.

Described from a full fed larva found in Shillong 23-iv-41, spun 27-iv-41 and a female emerged 17-v-41.

A larva found at Peshoke (2,500 ft. Darjeeling District) in December 1937 on Tea was similar to the larva of *P. scintillans scintillans* (mihi, *Journ. Bomb. Nat. Hist. Soc.*, xl, 406), but unfortunately failed to emerge so that it was impossible to be certain whether it was of ssp. *limbata* or not.

LASIOCAMPIDAE.

Metanastria lidderdalii Btlr.

Head pale grey, striped with darker. Ground colour of body whitish, overlaid with minute specks and streaks of grey, black, pink, brown and green and giving a general greyish appearance tinged, in some examples, with brown, pink or green. 1st somite with deep crimson subdorsal blotches marked externally with dark blue and with a broad dark dorsal stripe, which continues onto the 2nd somite where it is lost in the dense hair. A dark zig-zag subdorsal line from the 4th to 11th somite enclosing a dorsal series of dark shield-shaped marks. A constant feature is a pale grey shield-shaped mark on the posterior portion of the 7th and anterior portion of the 8th somite. 5th to 11th somites with oblique pale lateral stripes. Some larvae with deep cherry red blotches laterally. 2nd and 3rd somites clothed dorsally with a dense mass of short purple-blue hairs intermixed with a few longer white-tipped hairs and with five transverse bands of short white spatulate hairs running through them. A sublateral series of large tubercles bearing fringes of grey hair. 4th to 10th somites with subdorsal pencils of a few longish black hairs. 11th somite slightly humped and it and the 12th somite with a few single longish black hairs. Venter pale grey with a deep pink central stripe. Legs deep pink. Prolegs greyish. Spiracles dark grey ringed with whitish. When at rest the hairs on the 2nd and 3rd somites are not very noticeable, but when alarmed the head and 1st somite are doubled underneath the body, erecting a dense fuzz of sharp hairs, and the whole of the forepart of the body is lashed from side to side.

Cocoon boat-shaped of tough greyish silk shaded with yellow, and studded with the sharp larval hairs projecting point outwards. Usually spun along a twig. Pupa brownish black, the intersegmental areas dark olive brown. The abdominal somites with a

few very short hairs. Cremaster a bunch of short reddish brown hooked spines.

Food-plant—Pine.

Described from a number of full fed larvae found in Shillong, one of which spun 18-iv-41 and a male emerged 20-v-41.

LIMACODIDAE.

Mambarilla narosides Hering.

Head blackish, small, retractile. 1st somite pale purplish brown, retractile. Shape almost flat, very nearly diamond-shaped, the lateral edges scalloped. 2nd somite cut straight across and in four scallops. 8th somite broadest. 12th somite ending in two blunt points. Colour dull dark purplish, a dark rust-coloured broad dorsal stripe on 2nd to 4th somites, a dull whitish lateral mark on the 6th somite, the lateral area of the 9th to 11th somites dull whitish, 10th somite with a white dorsal bar with rounded ends and a paler dorsal blotch on the 12th somite. The lateral scallops ending in a few short bristles, white on the 9th to 11th somites, brown on the others. Venter whitish.

Cocoon small, almost spherical, of the usual hard Limacodid type. Colour silvery white with a slightly curved deep chocolate brown stripe on the top and an incomplete circle of the same colour at one end. Some have more than one stripe on top and may be marked at both ends.

Food-plant—Pear.

Described from a number of full fed larvae and cocoons found in Shillong 1-v-41, from one of which a female emerged 19-v-41.

NOCTUIDAE.

Acronicta indica Moore.

Head deep reddish chestnut or black, with an inverted V-shaped paler mark. Ground colour black, the intersegmental areas transversely lined with yellow. 3rd to 10th somites with an orange dorsal streak on the anterior portion of each somite and an oblique white stripe subdorsally. A zig-zag creamy subspiracular stripe with an erect pinkish-chestnut dash behind each spiracle. 1st somite with single longish pale hairs. 2nd somite with a double subdorsal tuft of white hair, 3rd somite with a triple subdorsal tuft of black hair, 4th to 8th somites with triple subdorsal tufts of white hair. All somites with single longish hairs. Legs chestnut. Prolegs pinkish-chestnut. Venter blackish. Spiracles white. One larva had the ground colour deep brown instead of black, the subdorsal tufts of hair pinkish brown instead of white and the subdorsal stripes reddish orange instead of white.

Cocoon spun, in captivity, among leaves and of golden brown silk. Pupa very dark purple brown, minutely punctate. Cremaster broad, a short point on either side and clothed with short straight dark brown bristles.

Food-plant—*Plantago* sp.

Described from a full fed larva found in Shillong 12-v-41; spun 16-v-41 and a female emerged 27-v-41.

The larva is very similar to that of the European *A. rumicis* L., with which the present species was formerly considered synonymous.

Geometridae.

Terpna ornataria Moore.

Head grey green, triangular and produced into a long point, bifid at the extreme tip. Body grey green, a yellow subdorsal line which ends by edging the anal flap, which is produced into a longish point. The dorsum, under a lens, minutely speckled with dull red, with larger dull crimson speck on the anterior portion of each somite dorsally and another subdorsally just external to the subdorsal line. A sublateral line, consisting of a white, a yellow and a brown line, starting from the posterior pair of legs and terminating on the 11th somite. Venter frosted green with a white median stripe, joined by dark-edged whitish oblique stripes with a dull red speck at the point of junction. Legs green, the 1st pair very small, the 3rd marked with red posteriorly. Prolegs green, the anal claspers with the apex dull reddish. Rests with the legs tucked in and the projection on the head forming a line with the dorsum, position slightly curved.

Pupa in a folded leaf spun together and lined with silk. Colour pale watery yellow-green, the head and prothorax pale olive-brown and with a pale spot ringed with chestnut enclosing the spiracle on the 9th somite. In all pupae found wild, the leaf had a hole bitten through it, through which this spot shewed.

Described from a full fed larva found in Shillong 24-iv-41, spun 26-iv-41 and a female emerged 17-v-41.

Anisodes obrinaria Guen.

Pupa shape triangular. Head truncate, thorax with the front produced into a pair of horns. Thorax not keeled. Colour pale green. Front edge of the thorax blackish brown, a dorsal red brown line. Abdomen with a red brown line on the posterior half, the line originating from a red brown spot. Formed on the surface of a leaf without any cocoon, the cremaster being fixed into a few strands of silk.

Described from a pupa found in Shillong 26-iv-41, from which a female emerged 30-iv-41.

(*To be continued*).

ON THE BANKS OF THE NARBADA.

BY

LIEUT.-COL. R. W. BURTON, I.A. (*Retd.*).

PART I.

(*With 4 plates*).

'Narbada Mai', or Mother Narbada as it is also reverently named, is considered by many Hindus to be the most sacred of all the rivers of India. It rises to the east of the Central Provinces, at Amarkantak on the borders of the State of Rewah, and enters the Arabian Sea near the town of Broach after a course of some seven hundred miles.

In earlier years it formed, with the forests and hills along its course, one of the main barriers which then shut off the peoples of Northern India from those of the Deccan. At the close of the triumphant career of Samudragupta, the second king of the Gupta dynasty, the Narbada was his southern frontier. He did not attempt to retain conquests made south of the river, and returned about the year A.D. 330 past the fortress of Asirgarh which is nowadays seen by railway passengers between the stations of Burhanpur and Khandwa.

The Narbada (Sanskrit, *Nar-Mada*, 'causing delight') is rightly named for it is a beautiful river through most of its long course, and to camp on its banks during the cold season is truly a delight. In the hotter months of the year the pleasure may be somewhat abated; but tiger and panther are more readily come by, and at certain places the fishing is good.

If one's stay is leisurely suitable swims can be baited with parched gram by means of which excellent sport is obtained. This gram fishing is a method peculiar to the Central Provinces, and an art in itself. Suitable equipment is a fly rod for fish up to 10 lbs. or so, a gut cast as fine as you dare use, and size 8 'model perfect' hooks. 'Fine and far off' is the maxim to bear in mind, and the threaded pellet must swim naturally with the other grains thrown in to accompany it down the stream; for any 'drag' will be fatal to success. And unless there is a ripple on the water it is likely that *all* the pellets will be sucked down *except* that to which one is expectantly attached! It is expert angling, can be most disappointing at times, and is not so simple as the chapter on the subject in the '*Rod in India*' by the immortal Thomas would lead one to suppose. Anglers wishing to have the fullest possible information and guidance as to gram fishing should refer to the excellent article on the subject entitled 'Fishing in the Rivers of the C.P.' by Maj. W. B. Trevenen which was published in the *Journal of the Bombay Natural History Society*, Vol. xxxiv, No. 3, p. 700 *et seq*.

Where there are boisterous falls in the river, as at Dhariaghat, there is excellent sport, using natural bait, with mahseer and a number of other predaceous fish both for a period when the water is subsiding after the rains and in the hot weather—March being the best month if the intense heat is not objected to. To hit off the former some considerable margin of time is necessary, or there may be disappointment due to late floods. The waiting days can be passed in pursuit of tiger and panther, in natural history observations, or just walks through an always interesting forest country.

One day three large stones had to be moved to one side of a forest track to clear the way for the cart. Under one stone was a snake, beneath the next a centipede quite eight inches long, and the third harboured a scorpion! Trails of large pythons are occasionally seen in sandy places; huge spider's webs are stretched from bush to bush; the night's tracks of all the jungle animals and birds are along the paths: so jungle strolls can be full of surprises to an inquisitive and observant eye.

There is much life on the river and along its sand banks and islands. We see a crocodile on a sand-spit, and perched on the near-by jutting branch of a submerged snag is a 'snake bird', as the Indian Darter is called by Europeans, and very snake-like he appears when his lean head and neck are protruded above the surface of the water after a dive. The specimen we see has his wings spread out to dry and looks like a bird on a lectern—or the German Eagle! At a respectful distance from the seemingly sleeping saurian are two brahminy ducks—Ruddy Sheldrake, to give them their other name. Wary birds they are, and without good reason, as they are not sought after by European sportsmen and are protected by Hindus, who do not like them being shot. Graceful river terns are seen sweeping over the water with light and airy flight, and kingfishers of three varieties are noticed; the black and white species ('The pied fish-tiger hung above the pool') being less common on this river than the larger and smaller coloured ones—the common Indian kingfisher, with appearance and habits of the one so familiar to us in the British Isles; and the Indian white-breasted kingfisher, with large, conspicuous red beak.

Cormorants are common, and that curious bird, the Indian Stone-Curlew, or Goggle-eyed Plover, is often flushed as we float silently in the dug-out past the islets of the river. Among the bright green foliage of the dwarf jamun bushes many small birds, bulbuls, warblers, sparrows and the like are seen and heard; while the ubiquitous king crows and their larger and more ornate relatives the racket-tailed drongos, are seen hawking the air from selected vantage points. Screeching paroquets weave emerald skeins among the tree-tops; egrets show dazzling white amid the dark foliage of the trees; there is the occasional splash of fish; and a wide ripple is caused by a crocodile having slipped silently into the stream from a sloping bank.

Troops of monkeys and lungoors, an occasional otter: all these and many other sights are the ordinary daily happenings; but all that is to be seen and noticed would fill a volume. Indeed this river is a delight not only on account of the many forms of life to be observed, but because of the changing forest scenery; the

gracefully waving bamboos, grasses and tamarisks; the lovely lights and shadows on the water; and the beauty of the crimson sunsets followed by the softening light of the risen moon which makes the wide river bed with the dark brooding forests on either bank a fairy land of magic and mystery.

The rainy season in the north-western part of the Central Provinces is frequently prolonged into October, so when setting out late in September we knew there might be some unpleasant weather and cart tracks in a bad state. However, after two marches to cover the twenty-four miles from the small wayside station we pitch camp within sight and hearing of the falls under the scanty shade of small teak trees from which the leaf has mostly fallen.

Above the basaltic barrier the river is now some four hundred yards in width, narrows to a hundred and fifty, and tumbles in separate cascades of varying volume over the rocks through which it has cut its way during countless centuries. It is a fine sight.

Below the falls the perpendicular rocks confine the river in a gorge eighty to a hundred yards wide, to open out and again contract, and so make its way for twenty miles to Mandhata, where are famous temples and a cliff from the summit of which human sacrifices took place up to the year 1824, when the country came under British dominion at the close of the Third Mahratta War. It is plain to the eye that the falls we now see were, ages ago, some eight hundred yards further down; and aeons before that again, several miles below.

By the side of the path approaching the sacred river is a small temple dedicated to Mahadeo, from within which issues the almost unceasing chant of the solitary priest. All through the day and night, with but short intervals for rest and food, he drones away; and so passes the monotonous days of his earthly existence in contemplation and hope of the Nirvana he aims eventually to attain. He is one of the really earnest devotees and has been here three years, alone in the tiger-haunted forest, with no human dwelling within miles of him on this side of the river.

In earlier days similar devotees were carried off from the jungle temples at Amarkantak by man-eating tigers: and that may be so occasionally even at the present time.

Early on the 4th October we are on the rocky bank below the nearest fall. The water is beginning to clear; so a good sized murral is seen cruising about. With us is a *dhimar,* a man of the fisherman caste summoned from the Dhar State on the further bank. Having lived much of his life with the roar of the falls in his ears he has acquired a habit of conversing by signs, so interprets his meaning by taking off his loin cloth which he fashions by means of pieces of driftwood into a sufficiently serviceable net. Squatting at the edge of the rough water he has in a few moments bait for the undoing of *Ophiocephalus striatus*—and whitebait for our dinner! He then takes the small rod set aside for his use, attaches a treble hook to the line, and, stalking the place, quietly drops his bunch of wriggling fry into the rushing stream ten feet below. In less than no time the reel is singing a merry tune. 4 lbs. and 24 inches long: one of the best eating freshwater fish of India. But all murral are not so simple as that.

On the other side of the river, where the rapids from the main fall sweep in rushing eddies along the rugged rocks, are two men with sixteen-foot bamboos and twenty feet of cord. Using dead bait they search the likely places with perpendicular lines and we see three large murral unceremoniously lifted out of the water. 'Sometimes,' says our henchman, 'they catch as much as three maunds of fish in a morning'. It is mahseer we want and not these coarser fish. The water is too coloured for spinning and we try live bait without result, for the river is rising fast and there must have been heavy rain higher up.

In the evening we go to see the reported tracks of a tiger. A fine fellow he is by his footprints, of which we see both old and new, so know that the sandy ravine is where he passes regularly on his rounds. A tree for a machan chair is selected. There being no suitable root or stump to which the young buffalo can be picketted, a trench eight feet in length and a foot wide is dug, with a further length tunnelled at each end, so that a ten-foot log can be sunk two feet below ground level. Round the log is passed a flexible wire rope with a loop at the surface to take a similar rope for attachment to the poor boda's foreleg. The loop round the animal's leg is carefully padded. The sand being filled in and well rammed down over stones, adding to the weight, all is secure. No tiger can move such a fixture.

A tiger killing at this prepared dinner table should be as good as bagged. There must be no wounding; for, the jungle, apart from any other consideration, is so thick at this season that the following up of a wounded beast would almost amount to suicide: yet it would have to be undertaken for such are the ethics of the game.

Next day a thunderstorm makes everything damp and uncomfortable, but on the following morning a cloudless sky evidences more settled weather. The water is now less coloured and a 3-lb. mahseer is secured on a spinning dead bait, and in the afternoon another of the same size on the further side of the river. Next morning two mahseer of 5 and 6 lbs. are taken, also on spinning tackle, and then the uncertain weather brings the river down in heavy spate. The rain to cause this six-foot rise must have been a long way off and very heavy: probably it was around the head waters on the Rewah border. Here is a cloudless sky, hot sun, and chilly nights. At 6 a.m. it is 66° and 96° at 2 p.m.

For twelve days the river continues in flood. Neither we nor the locals take many fish, and none of them are mahseer. For days our desultory efforts produce only *tengra* of one to three pounds weight. These scaleless fish afford no sport, but are good to eat. Several *perrun,* also of the family *Siluridae,* are caught on live bait, the largest 8 lbs.—ugly fish having enormous mouths full of rows of sharp teeth. All fish of this 'cat-fish' family are voracious feeders, and some of them grow to a great size—six feet in length, and 200 lbs. and more in weight.

In 1891 I hooked one quite six feet long, from the stern of an Irrawaddy paddle-wheel steamer lying at anchor for the night below Katha. A lascar foolishly touched the taut line with the boat-hook so the monster escaped. A *wallago-attu*—perrun—of 23 lbs. seized a *rohu* (carp) of seven pounds while the smaller fish was being

ON THE BANKS OF THE NARBADA

Fig. 1.—Dasara Festival at Dhariaghat.

Fig. 2.—Dhariaghat Falls on the Narbada; tiger and mahseer, both are here.

ON THE BANKS OF THE NARBADA

Fig. 1.—A 20 lb. Mahseer.

Fig. 2.—Perrun, 14 lbs.

played in the lake at Mahoba; after he let go a 2-lb. *rohu* fished as live bait brought about his speedy capture.

Sometimes we sit and watch the leaping fish. Gallant efforts they make to ascend the foaming falls and cataracts; some must succeed, but most appear to fail. Our greatest admiration is gained by the tiny heroes which leap from the foaming torrent against the slippery sides of the rocky walls. There they cling, panting, with down-pressed pectoral and ventral fins; wriggle up a little, take a rest, wriggle again, and so, by difficult inches, climb five feet of rock—mostly perpendicular and sometimes overhanging—until they meet the water trickling over at an edge. Then a final effort is made and the gallant mite rushes into the flood to be instantly borne away down the fall he has been instinctively endeavouring to surmount.

It is only very wee minnows which attempt the ascent in this manner. The others are ceaselessly leaping, leaping, mostly without avail: and the loin cloths are busy all the time.

On the 13th October there was a great gathering of people from far and near, the occasion being the annual Dasara festival—the Durga-Puja of the Bengal Presidency. On this day there will have been similar gatherings at all the ghats and temples throughout the course of this sacred river.

It is a gay scene we look upon. The rugged, rocky shores of the river are crowded on both banks with gaily apparelled men, women and children, for this is a universal Hindu outing similar to a British bank holiday. Bullock carts, palanquins, ponies, are scattered among the throng, and the smoke from many fires rises in the air. There is a great washing of clothes, performing of various ceremonies, and offering of coconuts. Below the falls are several large boats which have brought people from Mandhata, and the boatmen are reaping a rich harvest of the nuts from the stream, vieing with each other in racing down the flood to secure them. By evening all these thousands of people have left to return to their homes.

Next day there is news of a large cow buffalo having been killed by a tigress five miles upstream. We hasten to the place with a young companion who is in camp with us for a week or so. Mr. Verdant Green—for so we may name him concerning all that pertains to shikar, is full of hope, but it is not until 5-30 p.m.—much too late for such an affair—that we leave him perched in a machan chair for this first experience of sitting up for a tiger.

In the morning we find tracks of the tigress all around the kill, and learn she was heard sniffing under the machan early in the night but gave no other sign of her presence. She may have been within hearing when the machan was being made ready, or suspicious because the kill had perforce been dragged some twenty feet; or, more likely, had detected the occupant. Another all night vigil by our young friend afforded him the further experience of seeing five hyaenas at their loathly repast, for the weather was warm, and the poor buffalo hastening towards dissolution.

On the way back to camp we see tracks of other tigers, and a bear, along the sandy banks of the river, and at a village talk to an old man—eighty he says he is, perhaps he is sixty. A couple

of months ago he heard a disturbance in the calf-shed near his hut. Entering with a man holding a lantern he found a large male panther had seized a calf by the throat. Graphically he illustrates how he severed the marauder's spine with one stroke of his axe and wholly disabled it with further blows, the final stroke almost cutting its head in two. Such killing of panthers with axes is not uncommon: even tigers have been slain in like manner by plucky herdsmen.

In the evening we take our first large mahseer of the trip, large for this river. He seized the spinning dead bait in a small eddy just off the main rapid along the further bank so was into the flood and eighty yards below in no time. The fish then reached more placid water at the entrance to a bay, but the clamber along the rocks took some time and there was a loose line now and then; a fall would have been painful, and dangerous in places. However all was well and the fish duly played out and netted. 20 lbs., 31 ins. long, girth 22 inches; a handsome mahseer with dark blue back and portly outline.

The sky is dark and lowering as we take the photograph. The *dhimar*, picking up his rod, hurriedly laid down when he heard our yell above the roaring of the waters, finds his minnow has been pouched by a mottled green snake and the line in a fine tangle. The light is now too bad for a photograph and we are eager for another fish. Several are seen to leap in the tumbled turmoil of the rapids; there is one savage tug at the bait but no hold taken; so we put up our tackle, trudge up the bank to the boat, and cross the river after the most gorgeous sunset it is possible to imagine.

This sudden activity of fish, and the flaming sky, was a sure presage of the storm which gathered next day to burst upon us from 3 p.m. to midnight. Every day we take coarse fish: *tengra, perrun, bekri,* eels, and realize, as indeed we well know, that this month of October is too uncertain for mahseer fishing in this river. March is the month. Then are golden days and silver nights, mahseer, tiger, all delights! The days more red-hot than golden, but sport would compensate and risk of fever be less.

On the 25th October two small mahseer taken on spinning tackle are returned to grow larger, and the twin brother of our acquaintance of last Sunday is seen rolling like a porpoise in the swirling foam. Now the water is clearing, and there will be no more rain. Early in the month there were flights of duck and teal moving up and down, but none have been seen lately. Daily we see the three varieties of kingfisher, fish hawks, kites, ubiquitous crow, and blue rock pigeons. On only one day was a mugger seen and he, a monster of his kind, cruising down the flood like a Thames steamer.

When asked if any of the villagers are ever taken by muggers the *dhimar* relates a wonderful tale. 'It was,' he says, 'about the time of the great upheaval (meaning the Indian Mutiny) that a boy took two bullocks to the river to drink. A mugger seized the lad by the leg; he held on to the head ropes. The saurian would not let go, nor did the boy, but the bullocks were strong and dragged both boy and crocodile to the village where the latter

ON THE BANKS OF THE NARBADA

Fig. 1.—A Narbada Priest.

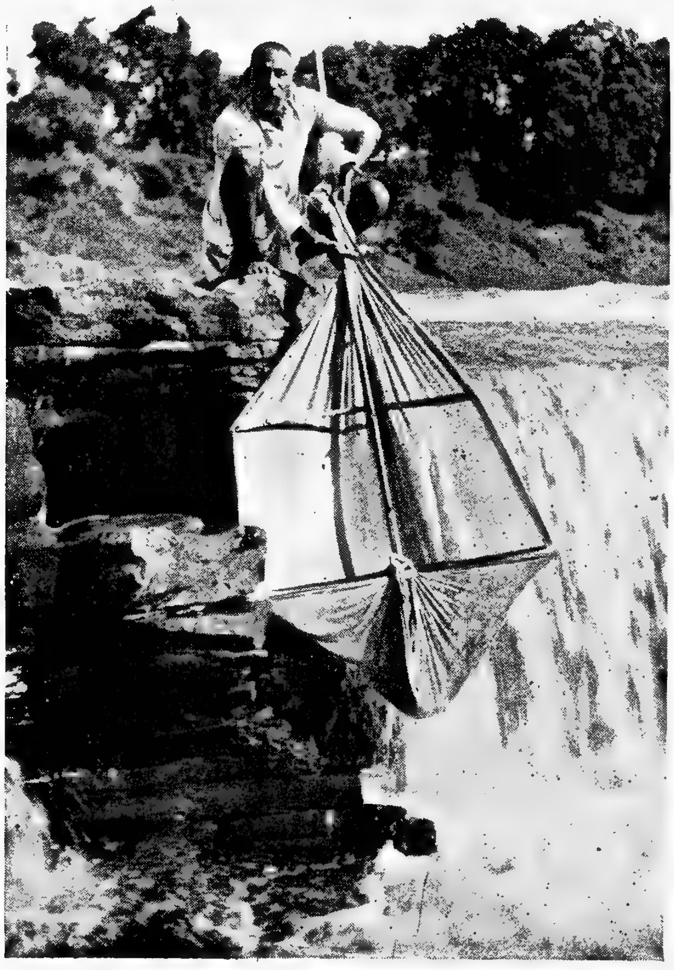

Fig. 2.—The *Dhobi* at work.

ON THE BANKS OF THE NARBADA

Fig. 1.—A centre cataract.

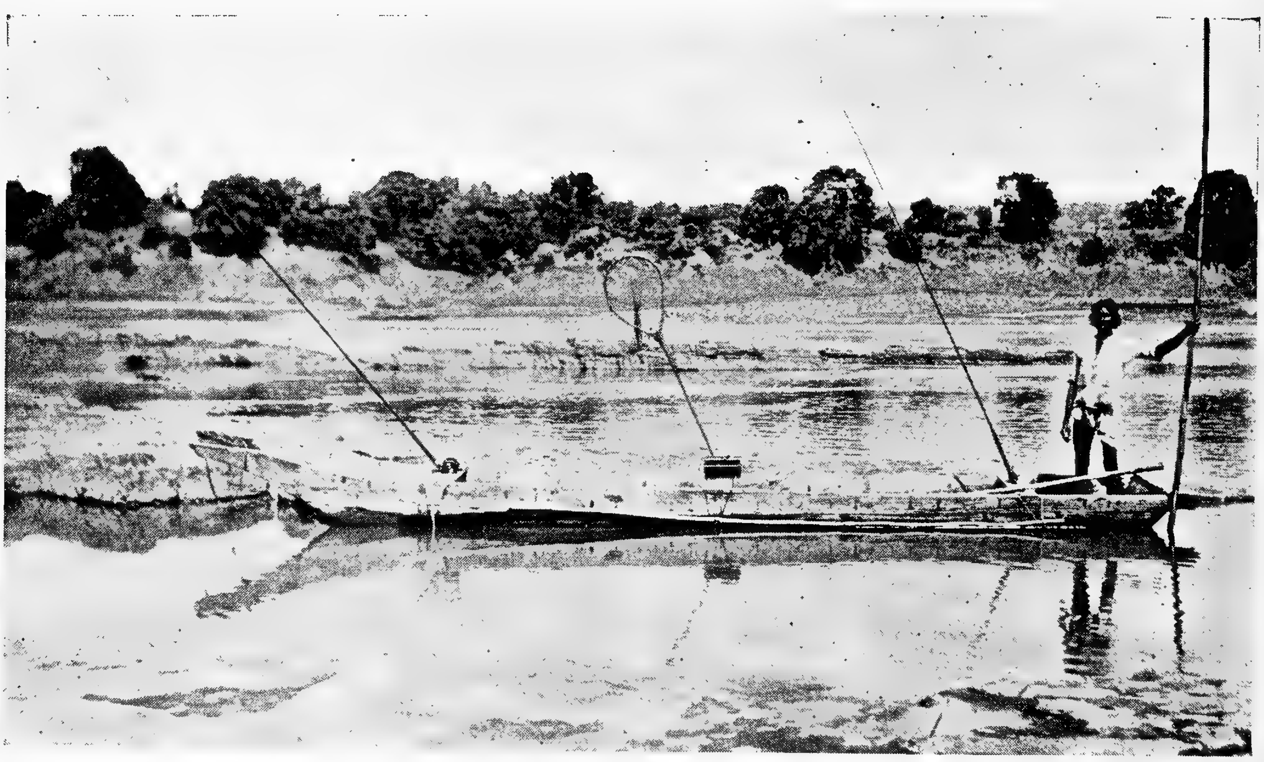

Fig. 2.—My fishing boat.

was despatched and the boy released'. A stout-hearted, also strong-armed village boy!

On the night of the 26th the tiger again took a stroll along the sandy shore of the river, passing between the two *bodas* without getting into touch with either of them. Yet the baits are tethered in carefully selected places where tigers have passed, and always do pass, on their nightly prowls. It is sheer bad luck and only two nights remain, for this outing must come to an end on the 30th October.

Now that the impetuous flow of the river has somewhat abated, the *dhimar* accedes to the suggestion that we can venture to the several falls and cascades accessible from the rocks in the centre of the rocky barrier. We go there in the afternoon and observe much of surpassing interest. Plain to the understanding are demonstrated the methods slow and sure by which the mighty force of the water continues to erode a way through the rocks and gradually destroy them. Very evident it is that during the ages to come the falls will recede further and further upstream.

First there is a small irregularity in the rock surface; a little sand whirled round and round forms a slight circular depression; then a few small pebbles continue the work; the boil becomes deeper, the pebbles larger: then arrive pebbles to size of a football and a large 'well' is formed. All of these processes are seen at work in the various stages. The result is that two wells are formed in proximity to one another. As they grow larger the sides give way and an arch is formed. Gradually the arch is weakened at the summit and worn away; then the rocks are tumbled into the irresistible flood to be eventually ground into sand. So it is that the relentless power of Nature is ever at work and 'grinds exceeding small'. As the various processes of formation of these 'boils' and 'wells' can only take place during the few months of the year when the river is in flood, and then works intermittently and at various levels, ages indeed must have gone to the making of the great gorge that we see.

We go to the principal cascade, where the two branches of it meet beneath an arch which will eventually collapse, and see two fat murral busily at work among the fry; and a large mottled-green snake—similar to he of the tangled line—is on a rock at the water's edge making quick lunges at the small fish leaping out of the stream as they essay ascent of the tumbled water. We see him catch one, and watch him dispose of it. Many he misses, and is not such a skilful fisherman as the 'pied fish-tiger' which hovers over a placid in-curving bay of the river further down.

At these centre cascades there is a great assembly of fish of all sizes, from minnows an inch long to fish of two or more pounds in weight: all of these in their countless millions are attempting the ascent, and adding the glitter of their silvery forms to the beauty of the foaming water.

The *dhoti* arrangement is soon at work to procure live bait, and in a few minutes a ten-pound mahseer, seizing it deep down under the arch, makes off down the further channel. The movement has been foreseen as, should the fish be able to turn the corner, all is lost for the line will be cut on the rocks and in any case the

fish cannot be landed. So no line is allowed and the struggler hauled back by brute force, the hook-hold being fortunately sound, and directed into the nearer rapid. Once in the swirl of that he could not be denied and is fifty yards downstream in a moment; then he is played out and brought to net in a small bay close by.

A six-pound mahseer is caught, and two much heavier ones lost by the hook-hold not being good enough to withstand the drastic methods necessary to prevent them going down the further flood. As the day draws to a close a 14-lb. perrun is landed after a good fight in the heavier water of another fall, and then we reluctantly pack up to clamber over the rocks to the boat.

We have stayed overlong, and it is nearly dark when we commence to pole upstream. Soon it is realized that it is not possible either to see the rocks below the surface, or which way the currents set, or to pole against the current. To be swept down either of the main falls a descent of forty feet—as must happen if the boat gets into the heavy force of the stream—means certain disaster; so we perforce return to the rocks resigned to the necessity of remaining marooned for the rest of the night.

No food, shorts and shirt! But the sky is clear, the moon will be up in half an hour, and a cleft in the rocks is found which will afford some shelter from the chilly wind to be expected after midnight. The *dhimar* collects driftwood; so has a fire and his evil-smelling tobacco to comfort him.

Soon the familiar star patterns and constellations are pricked clear upon a stainless sky shortly to be dimmed by the rising moon which sheds silver radiance over the upstream placid reaches of the river and enhances the magnificence of the wild turmoil of the falls and cascades. The night is very beautiful.

We wander about the rocks and watch the cascades and the leaping fish doubly silvered in the rays of the moon, a sight which will always live in the memory. The *dhimar* slaps his tummy to indicate it is time to roast some fish over the embers, so we are soon full-fed and ready for slumber which is somewhat slow to arrive owing to the vibration of the tortured rocks. The sun hat makes a sufficient pillow. The fisherman settles down close to the fire which he takes care to keep going through the hours.

Shortly after daybreak the friendly moon sets behind a giant mango tree on the further bank, the stars fade out in the pale blue sky, and the sun springs above the forest tree-tops to shed welcome rays on the scene. The fisherman sets about making arrangements to get the boat away. A long rope is signalled for from camp. He wades and swims to the bank to fetch it and a man to help. At the head of the rapid the man is left near a rock, and the *dhimar* returns to the boat which we pole to a place near the edge of the difficult water. Then the rope is fetched by the otter-like native, and fastened to the boat; it is nervous work to watch him, hampered by the long rope, swept in an instant some twenty yards down before he obtains a footing.

The boat is taken as far upstream as can be managed, to whirl rapidly down when let loose, but be pulled with success to the eddy below the rock. At last the adventure is safely ended. As we arrive the swollen bulk of a defunct bullock comes floating

down the river to be carried over one of the centre cataracts and be wholly disintegrated in the process. It is glad we are to have had a drink of river water before *that* came along!

In the afternoon we go again to the same place and have further success with mahseer and perrun, but take care to stop fishing in time to come away under similar arrangements to those of the morning. This is the end of the October outing. Six miles takes us to the forest rest house, near which is a sandstone fort about 150 years old in which European officials, ladies, children, refugees from Indore, were sheltered for some weeks during the troublous times of 1857, before they were moved for greater security to the Asirgarh Fort. The remaining eighteen miles to the railway station is done in a bullock cart during the cool hours of the night, and train taken at an early hour on the last day of October.

(*To be continued*).

A STUDY OF THE REAPPEARANCE OF TROUT FOOD IN TROUT WATERS IN THE KULU VALLEY (PUNJAB).

BY

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(*With 2 plates*).

In 1937 study of the food of Brown Trout (*Salmo fario* L.) in the Kulu Valley by examination of its stomach contents, had shown that during the months of July and August the monsoon rains caused heavy floods and produced disturbance in the supply of available trout food in the river (Hamid Khan, 1938). The Brown Trout in the Kulu Valley mostly feeds on insects and aquatic larvae clinging to the stones, and during the heavy floods most of the trout's food is washed off the stones. But as soon as the floods subside, it is found that the fauna of the stream has again made its appearance on the stones lying submerged under water. Investigations were, therefore, started in 1938-39 to study reappearance of fauna in the trout waters. No previous record of such a study is available in India, and its importance cannot be minimised. The results of such investigations are of the greatest practical utility to pisciculturist and can be utilized by him to develop the fisheries to their utmost capacity with due consideration to food available in the streams.

METHODS AND APPARATUS.

The commonest type of substratum in the Kulu Valley is stony and it is not practicable to use any dredging or grabbing method for collection of stream fauna. In addition to the fauna adhering to the stones, there is a swimming fauna and fauna lying in the sand and shingle under the stones. It would, therefore, not suffice to raise the stones over a given area for qualitative and quantitative study of stream fauna.

In order to overcome these difficulties, the apparatus, used for collection of fauna from selected areas in the trout waters in the Kulu Valley, was a modified form of the scoop recommended by Moon (1935) for an 'Investigation of the Littoral region of Oligotrophic Lakes'. The body of the scoop consists of a four-sided square box like structure, made of galvanized iron sheet, measuring 12 inches by 12 inches and with angle iron frame. Anteriorly, there are two iron hooks on either side of the frame for attachment of ropes and at its anterior ventral edge, the frame has an iron blade of two inches width. The iron blade is slightly inclined downwards. Posteriorly and situated dorsally, there is an iron socket for a five feet long wooden pole. To the posterior face of the

Fig. 1.—Scoop used for collection of fauna from streams.

Fig. 2.—The scoop in use.

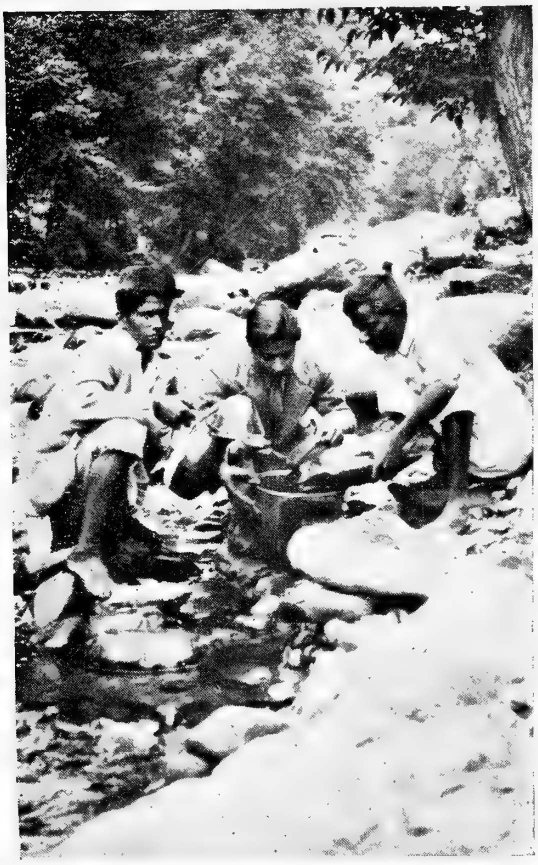

Fig. 1.—Washing organisms from stones.

Fig. 2.—Washing organisms from stones.

scoop is fitted a three feet long bag of strong coarse cloth, which is open at the bottom end, but closed tightly when the scoop is in use (Plate I, fig. 1).

To use the scoop, an area of six square feet is measured, the scoop is placed in shallow water near the bank with its face against the current of water (Plate I, fig. 2), the handle is pushed forward and the scoop is dragged slowly by means of the ropes. The blade of the scoop is pressed gently under a stone which is raised slowly and placed in the bag of the scoop. All the stones lying within the measured area are thus collected, washed carefully in a bucket with a soft deck brush so as to collect all the organisms on the stones, with due care so as not to damage them (Plate II, figs. 1 and 2). The swimming fauna, i.e. the fauna floating on the surface of water, which falls on it from overhanging trees or from other sources, within the measured area, is collected in the bag of the scoop.

When all the stones have been collected, the scoop is then dragged along the bottom, with its iron blade dug deeply into the substratum; collecting the last traces of the fauna present. The fauna, thus obtained in the bucket and net, is strained in muslin cloth and preserved in 70 per cent. alcohol for study.

The scoop has been found to work satisfactorily for collection of practically all the available fauna from the measured area.

Material.

The collection of the fauna was made from selected areas on either bank of the river Beas in the Kulu Valley between Sultanpur and Dramdhag—a distance of twenty-eight miles. The fauna clinging to the stones, lying within the measured area of six square feet, and totally or partially submerged in water, was collected, the stones were cleaned, and replaced in water and kept under observation.

The fauna collected from the stones was classified as 'rich', 'average' or 'poor' according to the quantity collected. The observations were taken twice a day. The period of time required for the fauna to reappear on the stones almost to its normal condition was recorded, and it was found to vary with the different collections made in different months.

The fauna collected from the stones mostly consisted of insect larvae belonging to the orders Trichoptera (Caddis fly), Ephemeroptera (May fly), Diptera, Coleoptera, Hymenoptera, Lepidoptera, Plecoptera and Neuroptera. Trichoptera included the sub-families *Sericostomatidae, Hydropsychidae, Philoptomatidae,* and *Rhyacophilidae.* The May fly larvae belonged to *Ecdyurus* (Hepata geniidae) and *Cloen* (Baetidae). Coleoptera, Hymenoptera and Lepidoptera were meagerly represented. Neuroptera was represented by Sialitidae. Of all the insect larvae, Trichoptera and Ephemeroptera were the commonest.

It is thus evident that Trout's food, studied previously by examination of stomach contents (Hamid Khan, 1938) corresponded to a large extent to the fauna collected from the stones.

The total number of collections of fauna and number of

observations on reappearance of fauna on the stones from July 1938 to October, 1939, was 337 in each case, on an average of about 30 collections every month. No observations were recorded during winter months i.e. from November, 1938 to February, 1939.

Table I shows the average time taken in each month by the fauna to reappear on the stones almost to its normal condition. During the rains and just after the rains the fauna seems to take a longer period to reappear than that it takes before the rains. It may, however, be noted that such a comparison cannot be taken too far as the time taken by the fauna to reappear also varies according to its nature and its density. It is but natural that the time required for the 'rich' fauna to reappear on stones to its original condition is longer than the time that a 'poor' fauna takes to reappear even under normal conditions. During the rains, however, heavy floods cause a great disturbance in the fauna available in the streams, and it is very likely that the organisms clinging to the stones are washed off and get scattered in the stream. Consequently the reappearance of fauna on the stones takes a longer time.

Comparative Study of Fauna.

When the fauna had again made its appearance on the stones almost to its original condition, it was recollected from the stones lying in the measured area and compared with the original collection of fauna made before the stones were cleaned, marked and replaced in water for observations. Altogether eighteen such collections were made.

Table II gives the comparison of collections of fauna from the stones '*before cleaned*' and '*after cleaned*' stages. '*Before cleaned*' stage means the original collections and '*after cleaned*' implies the collection made after reappearance of fauna. It is to be remembered that the observations recorded in Table II were made mostly on collections from stones where fauna was 'rich'. Consequently the average period in Table I taken by the fauna to reappear during various months of the year is different from that given in Table II.

From the observations recorded in Table II it appears that the difference between fauna collected from the stones before they were cleaned, and the fauna when it had reappeared is negligible. In some cases Caddis and May fly larvae have appeared in excess and in other cases the difference is not very great. But in almost all cases the fauna[1] had reappeared to almost to its original strength.

Conclusion.

It has been interesting to find out from these observations that the trout food on an average reappeared after four days' time on the stones which had been cleaned and replaced in the stream. It can, therefore, safely be vouched that the disturbance caused by the floods in the fauna of the trout streams is of a temporary nature, and that the food resources of trout streams in the Kulu seem to be inexhaustible.

[1] 'Fauna' implies animal fauna. Plant life which was found on the stones along with the insect larvae in the collection is not included.

Summary.

1. Reappearance of fauna on stones submerged in water in River Beas in the Kulu Valley was studied in 1938-39.

2. Scoop used for collection of material from large stones, gravel and sandy substratum is described.

3. The fauna was collected from six square feet area from selected areas on either bank of river Beas.

4. The stones from which the fauna was collected were cleaned, marked, replaced in water and kept under observation.

5. Average period taken by fauna to reappear varies from 63 hours in March to 138 in October.

6. The fauna collected originally did not differ much from the fauna collected after its reappearance.

7. The results of the investigations show that food resources of trout streams in the Kulu Valley seem to be inexhaustible.

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TABLE I.

Showing the average time for the reappearance of the fauna on the stones.

Year	Month	Average time taken for reappearance of the fauna on stones	Remarks
1938	July ...	125 hours	
,,	August ...	90 ,,	105 hours average. (During and after rains.)
,,	September ...	100 ,,	
,,	October ...	85 ,,	
1939	March ...	63 ,,	
,,	April ...	80 ,,	78 hours average. (Before rains.)
,,	May ...	91 ,,	
,,	June ...	79 ,,	
,,	July ...	No observations taken.	
,,	August ...	120 hours	
,,	September ...	125 ,,	122 hours average. (During and after rains.)
,,	October ...	138 ,,	

TABLE II

Showing the comparison of the Fauna at *Before Cleaned* and *After Cleaned* Stages.

Set of observations	Month	Time of reappearance of the fauna	Area of collections	Temperature	Kind of Fauna												Remarks
					Trichoptera	Ephemeroptera	Diptera	Coleoptera	Hymenoptera	Lepidoptera	Plecoptera	Neuroptera	Insect Larvæ un-identified	Mollusca	Pisces	Total of individuals	
1	March 1939	146 hours	6 sq. ft.	50°F 54°F	129 39	4 50	... 5	... ...	... ...	... ...	... 2	... ...	... ...	... ...	... ...	133 96	Before cleaned. After cleaned.
2	March 1939	141 hours 50 minutes	6 sq. ft.	50°F 50°F	13 32	50 25	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	63 57	Before cleaned. After cleaned.
3	March 1939	122 hours 55 minutes	6 sq. ft.	51°F 53°F	28 48	26 15	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	54 63	Before cleaned. After cleaned.
4	April 1939	117 hours 30 minutes	6 sq. ft.	51°F 49°F	102 118	15 12	... 2	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	117 132	Before cleaned. After cleaned.
5	April 1939	119 hours 15 minutes	6 sq. ft.	50°F 49°F	62 49	25 34	2 2	... ...	... ...	4 ...	... ...	1 ...	... ...	. 1	... ...	94 86	Before cleaned. After cleaned.
6	April 1939	170 hours 30 minutes	6 sq. ft.	53°F 54°F	72 70	6 16	... ...	... ...	... ...	... ...	3 ...	1 ...	... ...	... 1	... ...	82 87	Before cleaned. After cleaned.
7	April 1939	91 hcurs 30 minutes	6 sq. ft.	53°F 51°F	48 36	17 30	... ...	... ...	1 ...	... ...	... ...	... ...	1 ...	5 ...	... ...	72 66	Before cleaned. After cleaned.

8	May	140 hours	6 sq. ft.	56°F	49	17	1	...	...	...	1	...	...	...	...	68	Before cleaned.
	1939	30 minutes		53°F	32	23	...	...	...	...	8	...	...	...	...	63	After cleaned.
9	May	71 hours	6 sq. ft.	56°F	34	21	1	...	...	1	...	...	...	...	...	57	Before cleaned.
	1939	45 minutes		56°F	10	47	4	...	...	...	2	1	...	...	...	64	After cleaned.
10	May	141 hours	6 sq. ft.	52°F	42	30	4	...	...	...	...	...	...	...	...	76	Before cleaned.
	1939	45 minutes		52°F	38	28	...	...	...	...	2	...	...	...	...	68	After cleaned.
11	May	168 hours	6 sq. ft.	56°F	142	27	...	...	...	...	...	3	...	...	...	172	Before cleaned.
	1939	40 minutes		56°F	74	38	...	...	...	...	...	...	...	...	...	112	After cleaned.
12	June	119 hours	6 sq. ft.	53°F	30	15	6	...	...	...	...	...	...	...	...	51	Before cleaned.
	1939	20 minutes		53°F	...	43	...	...	...	...	...	...	...	...	...	43	After cleaned.
13	June	70 hours	6 sq. ft.	58°F	26	7	...	...	...	...	...	...	...	...	...	33	Before cleaned.
	1939	35 minutes		56°F	8	16	...	2	...	...	...	...	...	...	...	26	After cleaned.
14	June	119 hours	6 sq. ft.	72°F	34	12	...	...	...	...	1	...	...	...	...	47	Before cleaned.
	1939	10 minutes		70°F	14	30	...	...	...	...	...	...	...	...	...	44	After cleaned.
15	August	118 hours	6 sq. ft.	63°F	37	8	...	...	...	...	...	...	...	...	...	45	Before cleaned.
	1939	15 minutes		68°F	23	18	...	...	...	...	...	...	...	...	...	41	After cleaned.
16	Sept.	103 hours	6 sq. ft.	52°F	8	52	...	...	...	1	...	...	...	...	...	61	Before cleaned.
	1939	50 minutes		51°F	...	72	...	...	...	...	...	...	...	...	...	72	After cleaned.
17	Oct.	194 hours	6 sq. ft.	56°F	85	72	...	2	...	...	3	1	...	...	...	163	Before cleaned.
	1939	30 minutes		50°F	79	78	...	...	...	...	1	...	...	...	...	158	After cleaned.
18	Oct.	189 hours	6 sq. ft.	54°F	90	44	...	...	...	...	3	...	...	...	...	137	Before cleaned.
	1939	30 minutes		45°F	72	53	...	...	...	...	1	...	2	...	...	128	After cleaned.

TABLE II

Showing the comparison of the Fauna at *Before Cleaned* and *After Cleaned* Stages.

Set of observations	Month	Time of reappearance of the fauna	Area of collections	Temperature	Kind of Fauna												Remarks
					Trichoptera	Ephemeroptera	Diptera	Coleoptera	Hymenoptera	Lepidoptera	Plecoptera	Neuroptera	Insect Larvæ un-identified	Mollusca	Pisces	Total of individuals	
1	March 1939	146 hours	6 sq. ft.	50°F 54°F	129 39	4 50	... 5	... ...	... ...	... ...	... 2	... ...	... ...	... ...	... ...	133 96	Before cleaned. After cleaned.
2	March 1939	141 hours 50 minutes	6 sq. ft.	50°F 50°F	13 32	50 25	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	63 57	Before cleaned. After cleaned.
3	March 1939	122 hours 55 minutes	6 sq. ft.	51°F 53°F	28 48	26 15	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	54 63	Before cleaned. After cleaned.
4	April 1939	117 hours 30 minutes	6 sq. ft.	51°F 49°F	102 118	15 12	... 2	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	117 132	Before cleaned. After cleaned.
5	April 1939	119 hours 15 minutes	6 sq. ft.	50°F 49°F	62 49	25 34	2 2	... ...	... ...	4 ...	... ...	1 ...	... ...	... 1	... ...	94 86	Before cleaned. After cleaned.
6	April 1939	170 hours 30 minutes	6 sq. ft.	53°F 54°F	72 70	6 16	... ...	... ...	... ...	... ...	3 ...	1 ...	... ...	... 1	... ...	82 87	Before cleaned. After cleaned.
7	April 1939	91 hours 30 minutes	6 sq. ft.	53°F 51°F	48 36	17 30	... ...	... ...	1 ...	... ...	... ...	... ...	1 ...	5 ...	... ...	72 66	Before cleaned. After cleaned.
8	May 1939	140 hours 30 minutes	6 sq. ft.	56°F 53°F	49 32	17 23	1 ...	... ...	... ...	... ...	1 8	... ...	... ...	... ...	... ...	€8 63	Before cleaned. After cleaned.
9	May 1939	71 hours 45 minutes	6 sq. ft.	56°F 56°F	34 10	21 47	1 4	... ...	... ...	1 ...	... 2	... 1	... ...	... ...	... ...	57 64	Before cleaned. After cleaned.
10	May 1939	141 hours 45 minutes	6 sq. ft.	52°F 52°F	42 38	30 28	4 ...	... ...	... ...	... ...	... 2	... ...	... ...	... ...	... ...	76 68	Before cleaned. After cleaned.
11	May 1939	168 hours 40 minutes	6 sq. ft.	56°F 56°F	142 74	27 38	... ...	... ...	... ...	... ...	... ...	3 ...	... ...	... ...	... ...	172 112	Before cleaned. After cleaned.
12	June 1939	119 hours 20 minutes	6 sq. ft.	53°F 53°F	30 ...	15 43	6 ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	51 43	Before cleaned. After cleaned.
13	June 1939	70 hours 35 minutes	6 sq. ft.	58°F 56°F	26 8	7 16	... ...	... 2	... ...	... ...	... ...	... ...	... ...	... ...	... ...	33 26	Before cleaned. After cleaned.
14	June 1939	119 hours 10 minutes	6 sq. ft.	72°F 70°F	34 14	12 30	... ...	... ...	... ...	... ...	1 ...	... ...	... ...	... ...	... ...	47 44	Before cleaned. After cleaned.
15	August 1939	118 hours 15 minutes	6 sq. ft.	63°F 68°F	37 23	8 18	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	45 41	Before cleaned. After cleaned.
16	Sept. 1939	103 hours 50 minutes	6 sq. ft.	52°F 51°F	8 ...	52 72	... ...	... ...	... ...	1 ...	... ...	... ...	... ...	... ...	... ...	61 72	Before cleaned. After cleaned.
17	Oct. 1939	194 hours 30 minutes	6 sq. ft.	56°F 50°F	85 79	72 78	... ...	2 ...	... ...	... ...	3 1	1 ...	... ...	... ...	... ...	163 158	Before cleaned. After cleaned.
18	Oct. 1939	189 hours 30 minutes	6 sq. ft.	54°F 45°F	90 72	44 53	... ...	... ...	... ...	... ...	3 1	... ...	... 2	... ...	... ...	137 128	Before cleaned. After cleaned.

THE INDIAN CADDIS FLIES (*TRICHOPTERA*).

BY

MARTIN E. MOSELY, F.R.E.S., F.Z.S.

(*With twelve plates*).

PART VIII.

(*Continued from page* 339 *of Volume* xli, No. 2, 1939).

SERICOSTOMATIDAE McLACHLAN. (*Contd.*).

LEPIDOSTOMATINAE Ulmer (*Contd.*).

Dinarthrum latum Martynov. Pl. 1. Figs. 1-4.

Dinarthrum (*Indodinarthrum*) *latum* Mart., Rec. Ind. Mus., 38, pp. 283-284, figs. 53-54, a-c, 1936.

Martynov describes the species as follows:—

'♂. Punjab. Punj-pul Nullah, about a couple of miles from Dalhousie, on the Dalhousie-Bakloh Road, 6,500 ft., v-27, S. L. Hora.'

'♂. Eastern Himalayas, Darjeeling, 11-vi-14, F. H. Gravely (defective specimen).'

'Similar and related to the foregoing species. Basal joint of the antennae nearly as long as the whole body, armed with two processes in the basal part. Anterior wings as in *D.* (*I*) *punjabicum* Mart., but discoidal cell is longer, the cell between $M_3 + CuA_1$ and CuA_2 much longer, cell $CuA_2 - CuP$, on the contrary, not as extended; anal stripe with spinules and scales, a little shorter and somewhat arcuate.'

'♂. Dorsal plate of the 10th segment short, with irregular hind margin; from the side, the 10th segment is higher than in *D. punjabicum.* Basal joint of the pedes genitales more elongated, second joint more dilated at its end; titillators also curved to the right.'

'Length of body 5-5·3 mm.'

Cotypes in the collection of the Indian Museum, Calcutta, I am unacquainted with this species.

Dinarthrum punjabicum Martynov. Pl. 2. Figs. 1-4.

Dinarthrum (*Indodinarthrum*) *punjabicum* Mart., Rec. Ind. Mus., 38, pp. 282-283, fig. 51, a-b, 52, a-c, 1936.

Martynov describes the species as follows:—

'11♂, 6♀. Punjab, Punj-pul Nullah, about a couple of miles from Dalhousie, on Dalhousie-Bakloh Road, 6,500 ft., v. 27, S. L. Hora.'

'♂. Head and thorax brown above, head transverse. Basal joint of ♂ antennae brown, nearly as long as the thorax and abdomen,

curved, directed forwards and clothed with rufescent hairs and outstanding thickened hairs; it bears at its inner side two processes, the basal long and curved and the second shorter, thread-like, yellowish, annulated with brown. 1st joint of ♂ maxillary palpi long, second shorter, slender. Coxae brownish, legs yellow, or somewhat brownish; tarsal joints darker at their ends. Anterior wings greyish-brown, clothed with yellowish rufous hairs and with black scales before and behind the longitudinal subdiscoidal groove; whitish spots of hairs at the end of SC, somewhat nearer to the base and at the end of M. Venation somewhat resembling that in *D. ferox* McLach.; discoidal cell rather short, but somewhat variable. M weak dividing at the base of discoidal cell into the fore branch, reaching the end of wing, and the weak hind branch soon uniting with CuA to form a common vein, then separating and forming probably M_3+CuA_1. Anal groove or stripe straight, distinct and extending a little beyond the end of DC; basal portions of CuP and of A_1 present; fork 5 (between M_3+CuA_1 and Cu_2) somewhat variable, but usually rather short; apical cell between the ends of CuA_2 and CuP extended, elongated; in the posterior wings discoidal cell sometimes closed by a cross-vein; sparse blackish scales present. In females DC in the anterior wings is also short, CuP, A_1, A_2 and A_3 connected behind by a post-costal vein, running near the hind edge of the wing; forks 1, 2, 3 and 5 present; basal joint of ♀ antennae twice shorter than in ♂, without processes.'

'Abdomen dark brownish.'

'♂. Side pieces of 9th segment with concave hind margins; 9th tergite almost triangular, with dark hind edge; 10th dorsal segment not entire, but divided by a median fissure into two portions, which, from above, are band-shaped, with hind margins nearly parallel to the hind edge of 9th tergite; side portions not projecting above. Second joint of pedes genitales elongated, slightly thickened in its distal portion; end part sub-divided by a small incision above into two small lobes.'

'Penis curved downwards; titillators originating from the left side of the penis; they are rather thick and curved to the right.'

'In ♀ anterior wings DC is also short, forks 1, 2 and 3 beginning at the same level.'

'Length of body 4 mm.'

'*Remarks*.—This species resembles *D.* (*Paradinarthrum*) *longiplicatum* Mart. and *D.* (*P.*) *mesoplicatum* Mart. but differs somewhat in the structure of ♂ genitalia, as also in the venation of anterior wings in ♂.'

Cotypes in the collection of the Indian Museum, Calcutta. I am unacquainted with this species.

Dinarthrena gen. n.

Spurs, 2, 4, 4. In the ♂, the basal joint of the antenna is armed with either one or two processes. Wings clothed with hairs and scales; in the anterior, the post-costal fold varies in length; discoidal cell long and narrow; in the posterior wing, the discoidal

cell is sometimes wanting, possibly aberrantly. Penis-sheaths present. Inferior appendages branched or unbranched; no upright branch at the base.

Genotype.—*D. shanta* sp. n.

Dinarthrena shanta sp. n. Pl. 3. Figs. 1-5.

Insect dark brown. In the ♂, basal joint of the antenna rather short and stout with a claw-shaped, angular branch at the base, somewhat transparent in the type; palpi short, probably two-jointed but obscured under the thick clothing of hairs; anterior wing rather narrow with an acute apex, both wings clothed with hairs and scales; post-costal fold slightly more than half the length of the wing, terminating in a wide cellule and with only one large and rather shallow cellule between it and the posterior margin.

Genitalia ♂.—The apical margin of the ninth tergite produced in a wide triangle with a rounded apex; the dorsal plate is replaced by a pair of strongly chitinized and asymmetric spines arising from bulbose bases, that on the left with a basal spur arising on its upper margin; that on the right, with a small spur before its apex; penis short and curved; sheaths asymmetric, of unequal length; inferior appendages unbranched and terminating in a long, trumpet-shaped, narrow-stemmed, from above, extension arising from a broader basal part armed with various projecting processes; from the side, the extension terminates in a diamond-shaped dilatation.

Length of the anterior wing ♂ 6 mm.

Length of the basal joint of the antenna ·84 mm.

S. Shan States: Road 40 km. E. of Taunggyi, 13-x-1934, R. Malaise.

Type ♂ in the collection of the Stockholm Museum.

Dinarthrena steelae sp. n. Pl. 4. Figs. 1-6.

Insects brownish; in the ♂, the anterior wings are clothed with hairs and scales; there is a scale-lined, longitudinal groove through the centre and the usual fold in the post-costal area; all forks sessile and two large cells in the post-costal region; in the posterior wing, fork No. 1 with a footstalk in both sexes; an additional fork in both wings in the ♀; in the ♂, basal joint of the antenna of medium length, elbowed about midway; in the unique type, membranous with two membranous processes at the base but the remaining joints normal in texture; maxillary palpi two-jointed, basal joint long, terminal joint short; labial palpi, basal joint very short, second shorter than the third; spurs 2, 4, 4.

Genitalia ♂.—Dorsal plate from above, with the centre of the apical margin rounded, margin somewhat serrate, outer angles strongly produced; from the side, tapering to narrow, obliquely truncate apices, with a pair of triangular plates, directed downwards, arising from the centre of the dorsal plate, on the under surface; penis slender, arching downwards; sheaths symmetrically directed tailwards; inferior appendages perhaps two-jointed, stout

at the base, terminal joint partly welded to the basal joint with the apex produced in a small, inwardly directed plate.

Length of the anterior wing ♂ 6.5 mm.

Length of the basal joint of the antenna ♂ 1·9 mm.

Burma: Mishmi Hills, Chhaglon, 5,350 ft., 25—26-ii-1935, M. Steele.

Type ♂ and paratype ♀(?) in the collection of the British Museum.

These two insects, ♂ and ♀, belonging to the same genus and taken in the same locality on two successive days, probably belong to the same species but there is no direct evidence that they have been correctly associated.

I have pleasure in dedicating the species to Miss M. Steele who has devoted much time to collecting insects of many Orders in Burma and Assam.

Agoerodella gen. n.

Spurs, 1, 4, 4. In the ♂, basal joint of the antenna without processes. Maxillary palpi, basal joint very long, terminal short, almost rudimentary. Wings covered with hairs and scales; in the anterior, post-costal fold short, less than half the length of the wing; discoidal cell narrow. Penis-sheathes wanting. Inferior appendages single-jointed and unbranched.

Genotype.—*A. punkata* sp. n.

Agoerodella punkata sp. n. Pl. 5. Figs. 1-6.

Insect yellowish; in the ♂, wings covered with hairs and scales; anterior, discoidal cell rather short and narrow, shorter than its footstalk; post-costal fold short, cell between it and the posterior border long and narrow; seventh apical cellule closed with a broad cross-vein just beyond the termination of the post-costal fold; neuration of the posterior wing irregular, no discoidal cell, only fork No. 1 present; basal joint of the antenna about as long as the width of the head with the oculi, shrouded in dense hair which, when removed reveals a close row of stout spines of varying length; the inner surface of the joint is excavated to leave a ridged hollow darkly pigmented towards its distal half; maxillary palpi two-jointed, basal joint long, stout and curved, terminal joint very small; spurs 1, 4, 4, anterior tibiae considerably dilated; femur in the type, notched on its inner surface towards its distal end.

Genitalia ♂.—The apical margin of the ninth tergite produced at its centre; beyond is a dorsal plate forming a pair of long, finger-like, parallel and adjacent processes arising above the centre of a broad, triangular plate; penis broad and short, slightly arched, apex excised; inferior appendages single-jointed and unbranched, tapering from broad bases to much produced and rounded apices.

Length of the anterior wing ♂ 7·5 mm.

Length of the basal joints of the antenna 1.25 mm.

N.-E. Burma: Punkataung, 16-iii-1934, R. Malaise.

Type ♂ in the collection of the Stockholm Museum.

Adinarthrella gen. n.

Spurs, 2, 4, 4, or 1, 4, 4. In the ♂, the basal joint of the antenna rather short and without processes. Maxillary palpi two-jointed, basal joint abnormally bent and thickened before the apex, terminal joint normal. Wings covered with hairs and scales; in the anterior, costa folded over the wing towards its base; post-costal fold varying in length. Inferior appendages with the apices branched but without an upwardly directed process at its base.

Genotype.—*A. brunnea* sp. n.

Adinarthrella brunnea sp. n. Pl. 6. Figs. 1-5.

Insect dark brown; in the ♂, basal joint of the antenna not very long, without any basal processes and slightly elbowed before the apex; it is furnished with the usual hairs and scales; maxillary palpi two-jointed, basal joint elbowed in the basal half and enormously dilated at the bend, then the joint is narrow to the apex, second joint slender, about the same length or slightly longer than the narrow part of the basal joint; wings clothed with hairs and scales, the latter mainly confined to the veins; anterior, costal margin rounded, the costa at its base, doubled over the sub-costa, enclosing a pencil of hairs; discoidal cell long and narrow; no median groove; post-costal fold rather long; in the posterior wing, the 4th apical cellule extending not so far inward as the basal angle of the discoidal cell; spurs 1, 4, 4.

Genitalia ♂.—9th tergite produced at its centre in two long, slender, triangles separated from each other by a narrow excision; penis rather long and straight, apex excised, a pair of very slender sheaths along the upper surface but the structure is difficult to make out; inferior appendages single-jointed, branched with a broad base extending for about half its length; seen from the side, there is a somewhat slender branch arising from the apex of the broadened half, apex inturned, from above; the apical portion of the appendage is thickened with a convex lower margin; the upper margin of the appendage along the basal half, is strongly sinuate or S shaped; from above, the apices are dilated and rounded, particularly in the inner margins.

Length of the anterior wing ♂ 7 mm.

Length of the basal joint of the antenna ♂ 1.5 mm.

Assam: Shillong, 5,000 ft., 20-31-x-1934, Fletcher coll.

Type ♂ and paratypes ♂ and ♀ in the collection of the British Museum.

Adinarthrella inconspicua sp. n. Pl. 7. Figs. 1-7.

Insect brown; in the ♂ wings clothed with hair and scales, much denuded in the type, broad and rounded; anterior with the costa bent over along the basal third and there bearing long, stiff hairs; discoidal cell long and narrow; a faintly indicated fold in the post-costal area terminating on the margin of a rather large and somewhat round cell; posterior wing with the nervure closing the discoidal cell very weak, perhaps absent in one wing; fork No. 1 sessile; basal joint of the antenna about as long as the width

of the head with the oculi; maxillary palpi two-jointed, basal joint very stout and rather short, slightly curved, terminal joint slender and inconspicuous; basal joint of the labial palpi short and stout slightly curved; spurs 2, 4, 4, those of the anterior tibiae conspicuous.

Genitalia ♂.—The apical margin of the ninth tergite produced in a large, bifid process with a minute, triangular process at its base; penis short and straight, apex slightly excised; sheaths long with very acute apices; inferior appendages apparently two-jointed, from beneath, broad at the base and produced in a slender process of about the same length as the basal part; from the side this produced portion has a small projection on each side of its base, the lower bearing a peg-like tooth; from beneath, the appendages are widely separated with a slight projection at the centre of each inner margin.

Length of the anterior wing ♂ 6 mm.

Length of the basal joint of the antenna 0.86 mm.

N.-E. Burma: Kambaiti, 7,000 ft., 11-v-1934, R. Malaise.

Type ♂ in the collection of the Stockholm Museum.

Adinarthrella kimsa sp. n. Pl. 8. Figs. 1-5.

Description of the male; head fuscous, clothed with dense fuscous hairs; oculi black; basal joint of the antenna rather short, fuscous, densely clothed with fuscous hairs, remaining joints very pale ochraceous or golden with dark fuscous annulations; maxillary palpi two-jointed, basal joint bent at right angles about midway, terminal joint short; labial palpi, basal joint, as long as the second but shorter than the third; wings ochraceous, anterior with the costa doubled over at the base and enclosing a pencil of hairs; there is a central, curved groove lined with dark scales and a fold parallel with the post-costa; pubescence short and golden, excepting in the folds where it is darker; fringes dark; legs ochraceous, spurs 2, 4, 4.

Genitalia ♂.—Ninth segment produced in the centre of its dorsal margin in two long processes divided from each other by a narrow excision; from the side, the process is broad at the base with a deep, angular excision on the under surface before the apex which is stout and downwardly directed; penis short and arched, the sheaths as in *Dinarthrum,* directed asymmetrically to one side but perhaps aberrant; inferior appendages single-jointed, stout, from the side, a small process arising from the upper margin towards the base, apex bifurcate, the forks lying one above the other, the upper more strongly chitinized than the lower which arises from a somewhat swollen basal portion; from beneath, the lower fork is constricted before the apex which is triangular, its obliquely truncate margin covered with strong spines; the lower margins of the appendages are fringed with strong hairs.

Length of the anterior wing ♂ 6 mm.

Length of the basal joint of the antenna 1·2 mm.

Sikkim: Kurseong, 18-30-iv-1922. Fletcher collection. Type ♂ in the collection of the British Museum.

Adinarthrella parva sp. n. Pl. 9. Figs. 1-7.

Insects small and yellowish. Anterior wing ♂ with the costa folded along rather more than its basal half; post-costal fold long, extending nearly to the border of the wing; four large cellules between it and the posterior margin, the two nearest the apex about equal in size, the next the largest, basal cellule small; wings covered with hairs and scales. There are additional forks in both wings in the ♀. Basal joint of the antenna in the ♂, rather longer than the width of the head together with the oculi, no processes at the base; maxillary palpi membranous, possibly two-jointed, basal joint stout and elbowed, terminal, slender and straight; spurs, 1, 4, 4.

Genitalia ♂.—Dorsal plate produced in a long triangle with an excised apex; from the side, the plate is deep at its base, tapering to a rounded apex, lower margin straight, upper sloping downward; penis short and stout with a pair of short, slender sheaths; inferior appendages bifurcate towards the apex, no basal branch but a slight, hooked projection of the upper margin about midway; upper fork, from the side, slightly shorter and more slender than the lower.

Length of the anterior wing ♂ 6 mm., ♀ 7 mm.

Length of the basal joint of the antenna ♂ ·86 mm.

N.-E. Burma: Kambaiti, 7,000 ft., 28-v-1934; 1-v-1934.

Type ♂ in the collection of the Stockholm Museum. Paratypes of both sexes in the Stockholm and the British Museums.

Goerodes Ulmer.

Goerodes Ulm., Coll. Selys, Fasc. 6(1), pp. 37-38, 1907.

Goerinella Ulm., Deut. ent. Zeit, **1915**, p. 67, 1915.

Crunobiodes Mart., Ann. Mus. Zool. Acad. Sci. U.R.S.S., 28, p. 471, 1927.

Spurs, 2, 4, 4. In the ♂, basal joint of the antenna without processes. Maxillary palpi one- or two-jointed. Wings with a clothing of either hairs or scales or both; costa sometimes folded over the wing, sometimes normal; post-costal fold varying in length. Penis-sheaths absent. Inferior appendages branched, always with an upwardly directed branch at the base. Dorsal plate generally in the form of a pair of spine-like processes but sometimes the processes are fused together to make a plate of varying shape.

Genotype.—*G. cornigera* Ulmer.

Goerodes indica Martynov. Pl. 10. Figs. 1-7.

Maniconeura indica Mart., Rec. Ind. Mus., xxxviii, pp. 289-291, figs. 60-62, 1936.

Insect brown generally; in the ♂, basal joint of the antenna about as long as the breadth of the basal part of the head without the oculi; second joint short, third longer than the second or succeeding joints; maxillary palpi two jointed, basal joint darkly pigmented and pressed closely in front of the face, terminal joint small

and membranous, transparent; wings clothed with hairs only; there are no intermingled scales; a fold in the post-costal region of the anterior wing in which the discoidal cell is long and narrow; neuration in the post-costal region slightly aberrant in the type; in the posterior wing, the base of the fourth apical cellule extends very slightly further inwards than the basal angle of the discoidal cell; spurs 2, 4, 4.

Genitalia ♂.—9th dorsal segment with a triangular production of the centre of its margin; beyond it extends a dorsal plate dilating immediately beyond the base, constricted again before the truncated and excised apex; the upper surface of this plate is set with peg-like spines or teeth; penis short, curved, with a dilated and excised apex; no penis sheaths, inferior appendages possibly two-jointed, branched; terminal joint welded to the apex of the basal joint; this terminal joint forms a plate with a broadened, obliquely truncate apex and carries two minute finger-like processes on its inner surface, one of which is furcate; from the side, there is the usual short, upwardly directed branch arising from the upper surface of the appendage towards the base, and from beneath, each appendage has a short, stout branch arising towards its base along its inner margin.

Length of the anterior wing ♂ 5 mm.

Type ♂ and paratypes ♂ and ♀ in the British Museum and in the collection of the Indian Museum, Calcutta, from Peninsular India, Castle Rock, N. Kanara District, x.16; S. W. Kemp.

Ceylon: Matale, 4-i-24; Pundaloya, vii-98.

Goerodes inequalis Martynov. Pl. 11. Figs. 1-4.

Dinarthrodes inequalis Mart., Rec. Ind. Mus., 38, pp. 284-286, figs. 55-56 a-c, 1936.

Martynov describes the species as follows:—

'2♂, ♀. Western Himalayas, Kumaon Hills, Bhowali, bushes and trees, 12-v-30, H. S. Pruthi.'

'Head and thorax brown; head transverse; basal joint in ♂ antennae long, but shorter than the body, curved inwards, without any spines. Maxillary palpi densely clothed with greyish and black elongated scales, apparent basal joint probably represents an outgrowth of the palpiger; second (first) joint slender and directed upwards, third (second) joint slender, shorter than the foregoing. Labial palpi pale, fairly long, as usual three-jointed.'

'♂. Anterior wings greyish-yellow; DC elongated, but shorter than its pedicel; M dividing into two branches at the middle of DC, M_3+_4 near its base connected with a short cross-vein with CuA; this vein is long and curved at its end backwards and then prolonged with CuA_2; CuA_1 absent; cross-vein between CuA_2 and CuP long; before CuP and the basal part of A_1 is the anal groove with hairs, concealing the venation in the basal part. Posterior wings greyish, DC subelliptical; cross-vein rs-m connecting basal parts of RS_3+_4 and M_1+_2.'

'♂. 9th segment broad, narrowed above; side pieces with convex hind margins; sternite provided with two brownish lateral, straight,

chitinous thickenings. Median portion of 10th segment elongated, with a narrow cleft divided into two portions, bearing short erect hairs; seen from the side this portion of the 10th segment is narrow at base, gradually thickening to its end. Side portions of 10th segment (morphologically they probably represent preanal appendages) extended as two long sinuate processes of unequal length, the left being considerably shorter than the right. The right process is directed backwards, then curved upwards and outwards; acute end portion is turned backwards; the left process is curved in a similar manner, but its end portion is directed somewhat inwards. Basal joint of the pedes genitales brown, thick, straight, bearing on its end portion a tuft of long bristles; second joint pale, almost twice shorter, slender in its middle, at base uniting with first joint; internally from it originates the inner slender branch, and from the base of the first joint arises on each side another pale slender process directed rather upwards. Penis slender, arcuately curved downwards (titillators invisible, probably shortened or absent).'

'♀. Anterior wings brownish, venation as usual in females; forks 1, 2 and 5 present. Basal joint of antennae somewhat longer than the head with eyes.'

'Length of body about 5-5.5 mm.'

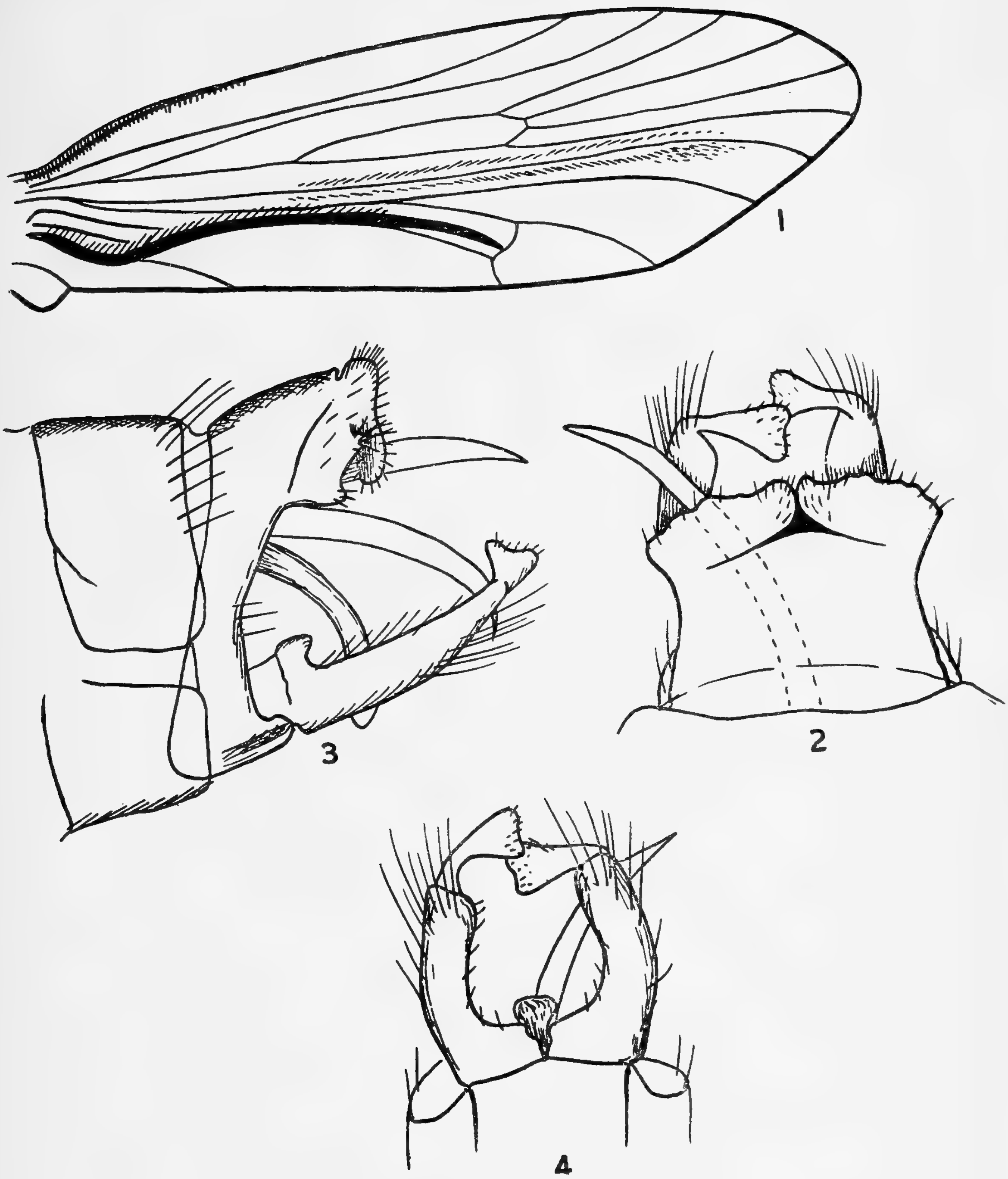
'Remarks.—Allied to *D. albardana* Ulm. but distinct, differing mainly in the structure of the 10th segment.'

Co-types in the collection of the India Museum, Calcutta. I am unacquainted with this species.

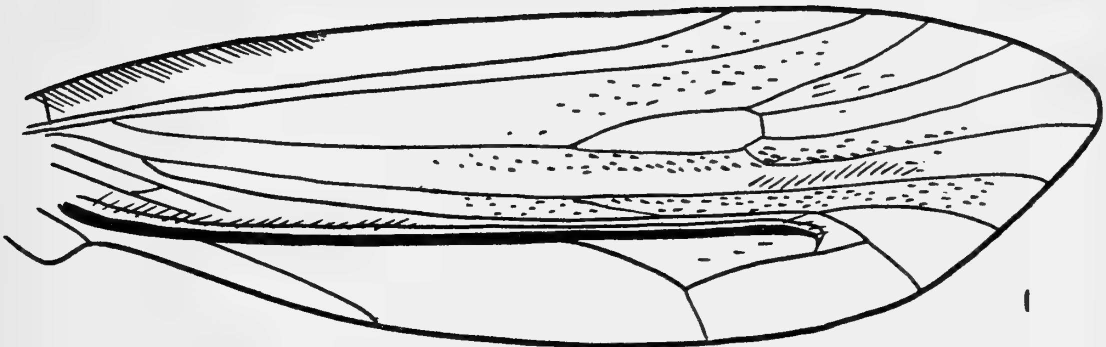
Goerodes kanda sp. n. Pl. 12 figs. 1-5.

Insects brownish; description of the ♂; basal joint of the antenna rather shorter than the breadth of the head with the oculi; maxillary palpi membranous, single-jointed with a small membranous nodule at the base and a sinuous apex; the whole palpi clothed with short broad scales with the lower half bearing long stiff hairs as well; the effect of this vestiture is to give to the joint the appearance of a bottle-brush; labial palpi, basal joint nearly as long as the second which is only slightly shorter than the third; wings, anterior, costal margin much more rounded than in *piscina,* costa folded over the sub-costa, rather more deeply towards the base; discoidal cell long and broad; post-costal fold extending practically the whole length of the wing, slightly dilated at the base; in the posterior wing, the fourth apical cellule extending further inwards than the basal angle of the discoidal cell; both wings clothed with scales as well as hairs; spurs 2, 4, 4.

Genitalia ♂.—The margin of the ninth dorsal segment produced in two pairs of processes, the outer, which are the longer, slightly asymmetric, stout at their bases, strongly chitinised, gradually tapering to acute apices; the inner are also strongly chitinised with broad bases side by side and touching each other in the lower half, then diverging widely; penis short, arching downward deeply



Dinarthrum latum sp. n. ♂. Fig. 1, Anterior wing. Fig. 2, genitalia dorsal. Fig. 3, lateral. Fig. 4, ventral.
(After Martynov.)



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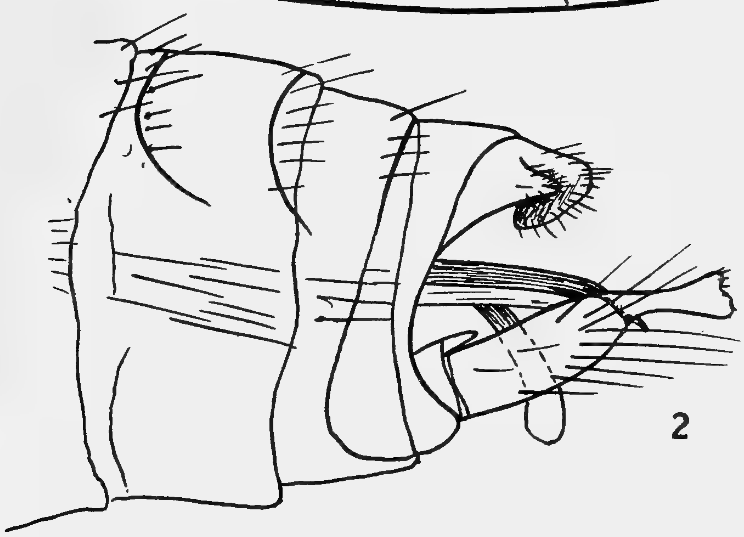

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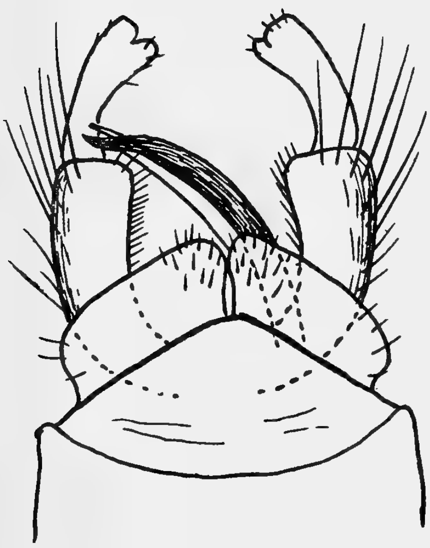

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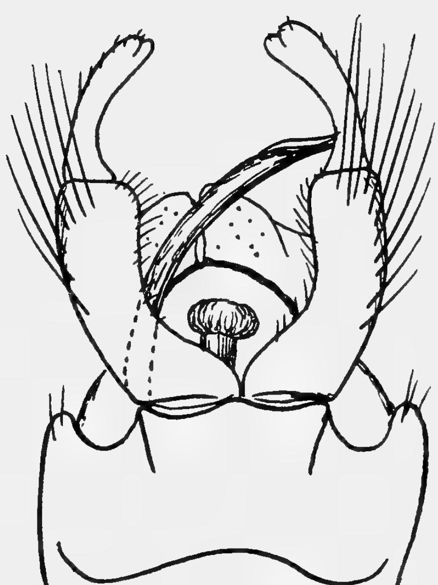
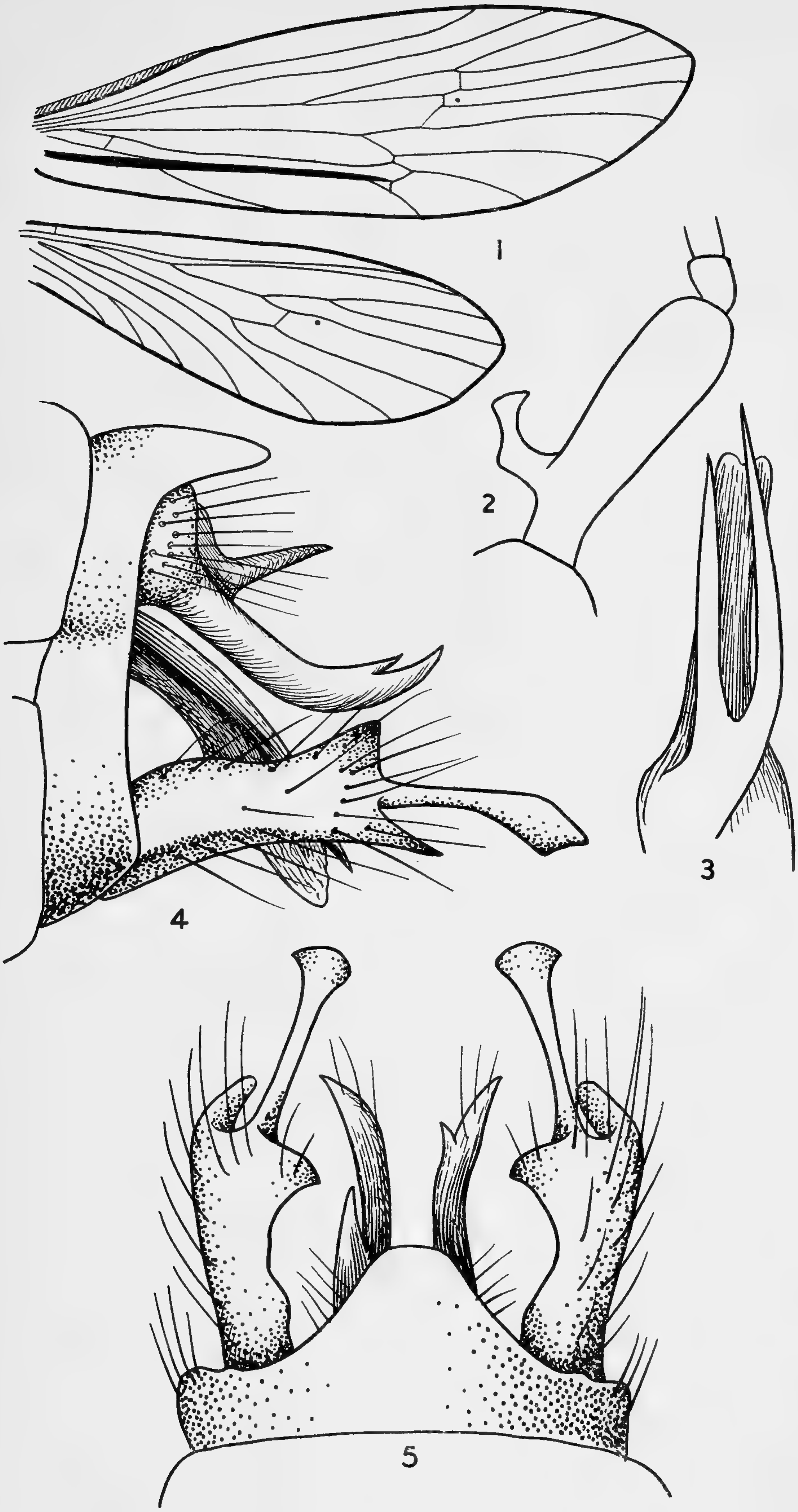
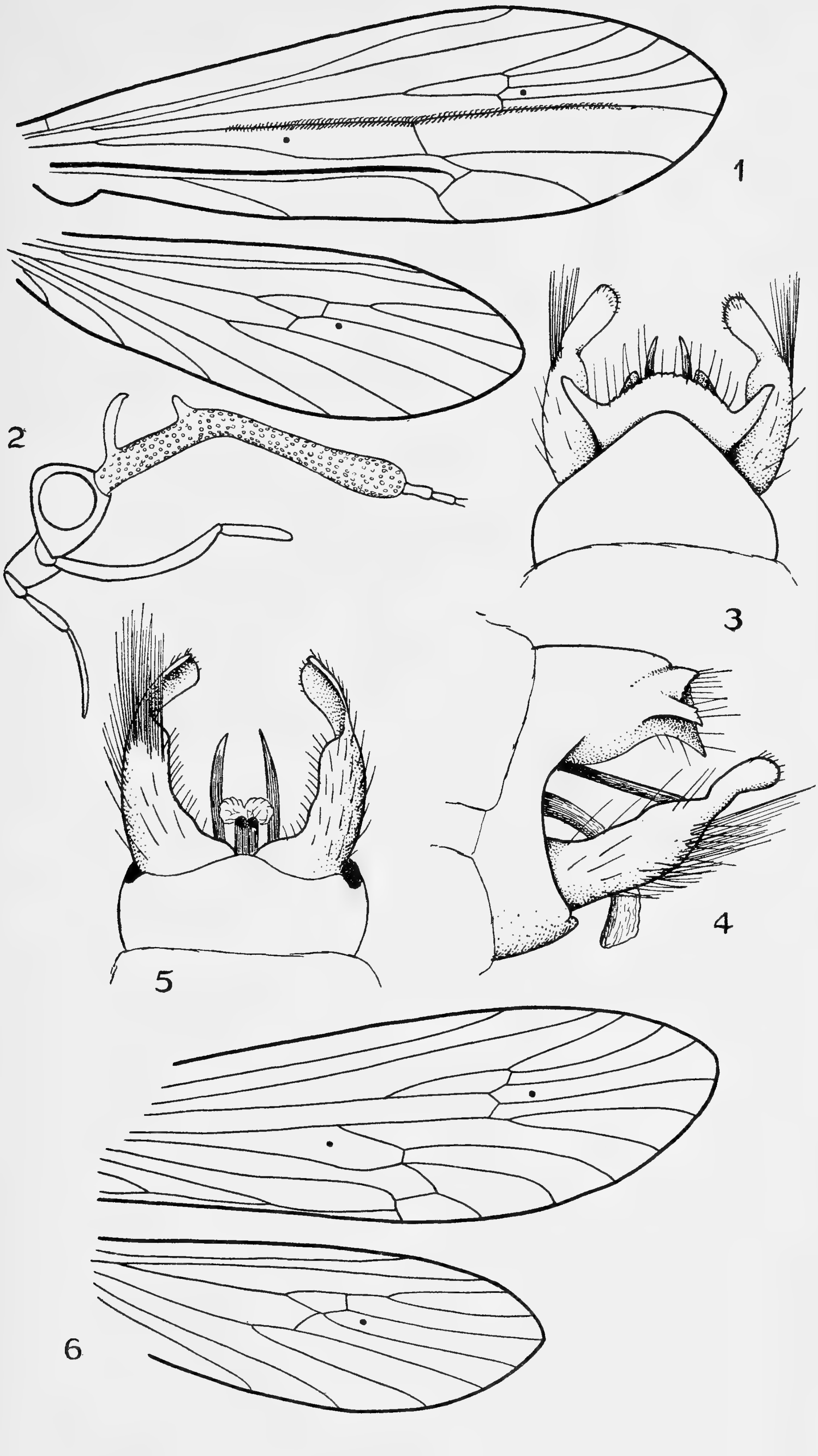


4

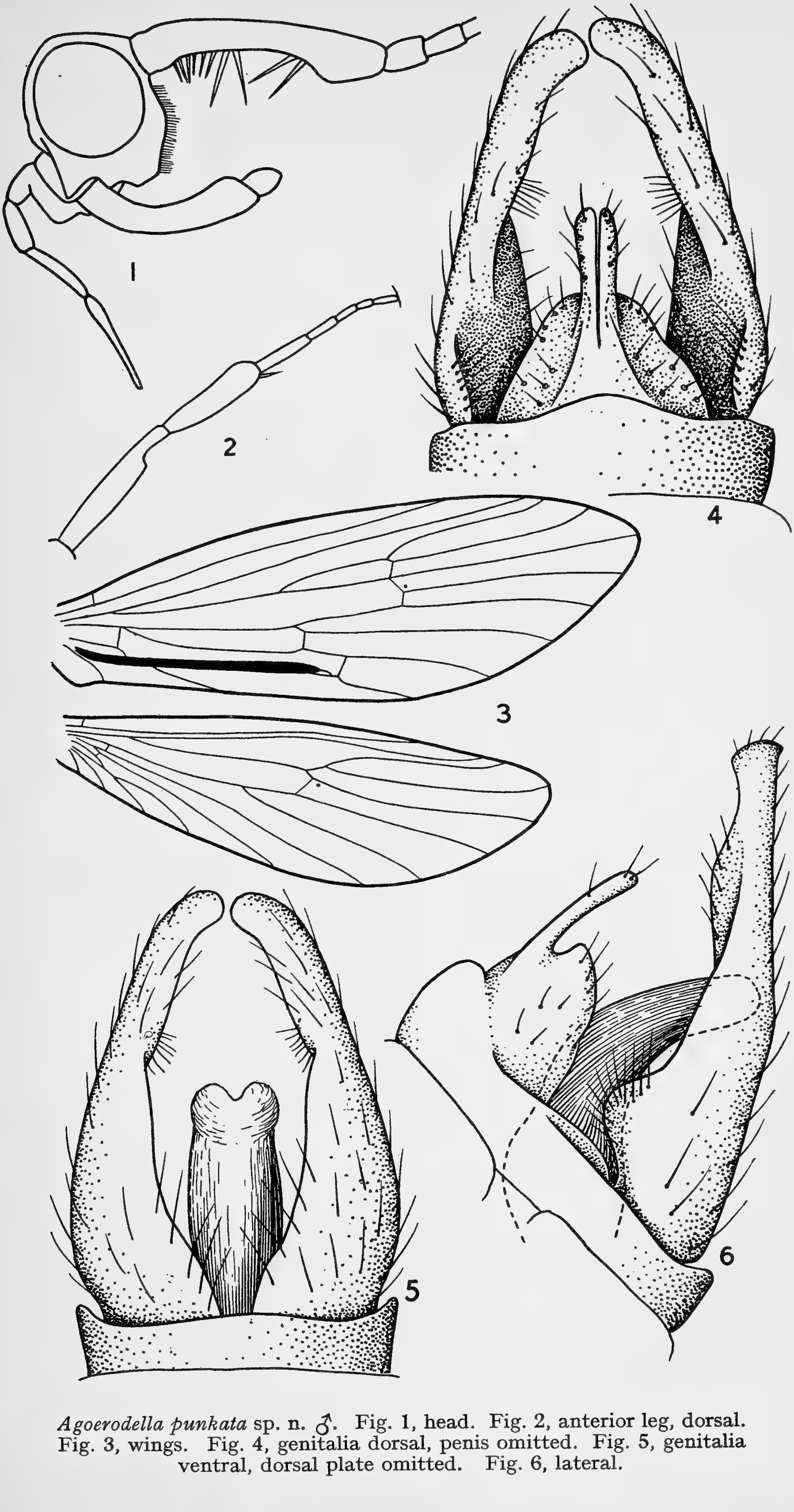
Dinarthrum punjabicum sp. n. ♂. Fig. 1, Anterior wing. Fig. 2, genitalia lateral. Fig. 3, dorsal. Fig. 4, ventral.
(After Martynov.)



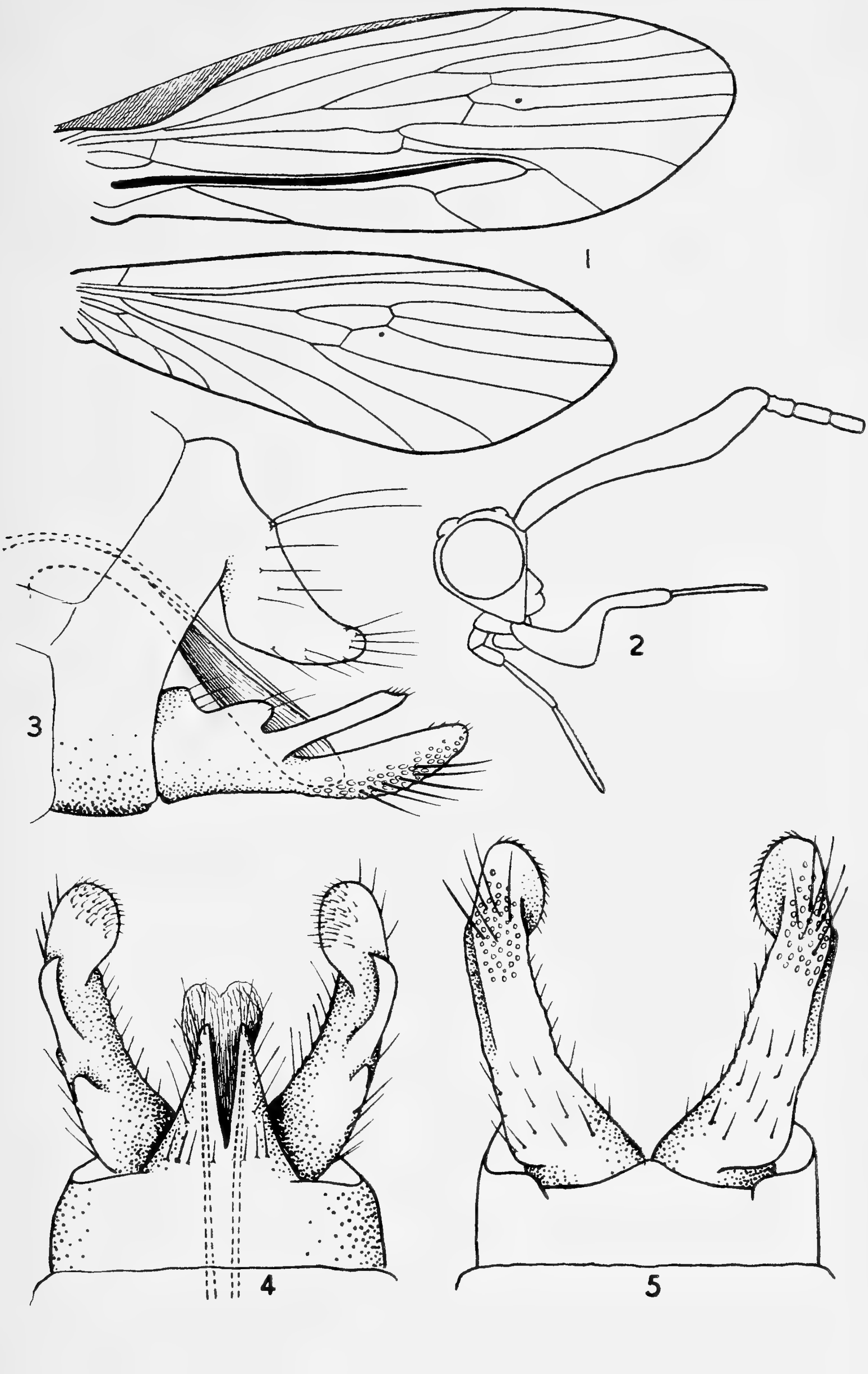
Dinarthrena shanta sp. n. ♂. Fig. 1, Wings. Fig. 2, basal joints of the antenna. Fig. 3, penis and sheaths dorsal. Fig. 4, genitalia lateral. Fig. 5, ventral, penis and sheaths omitted.



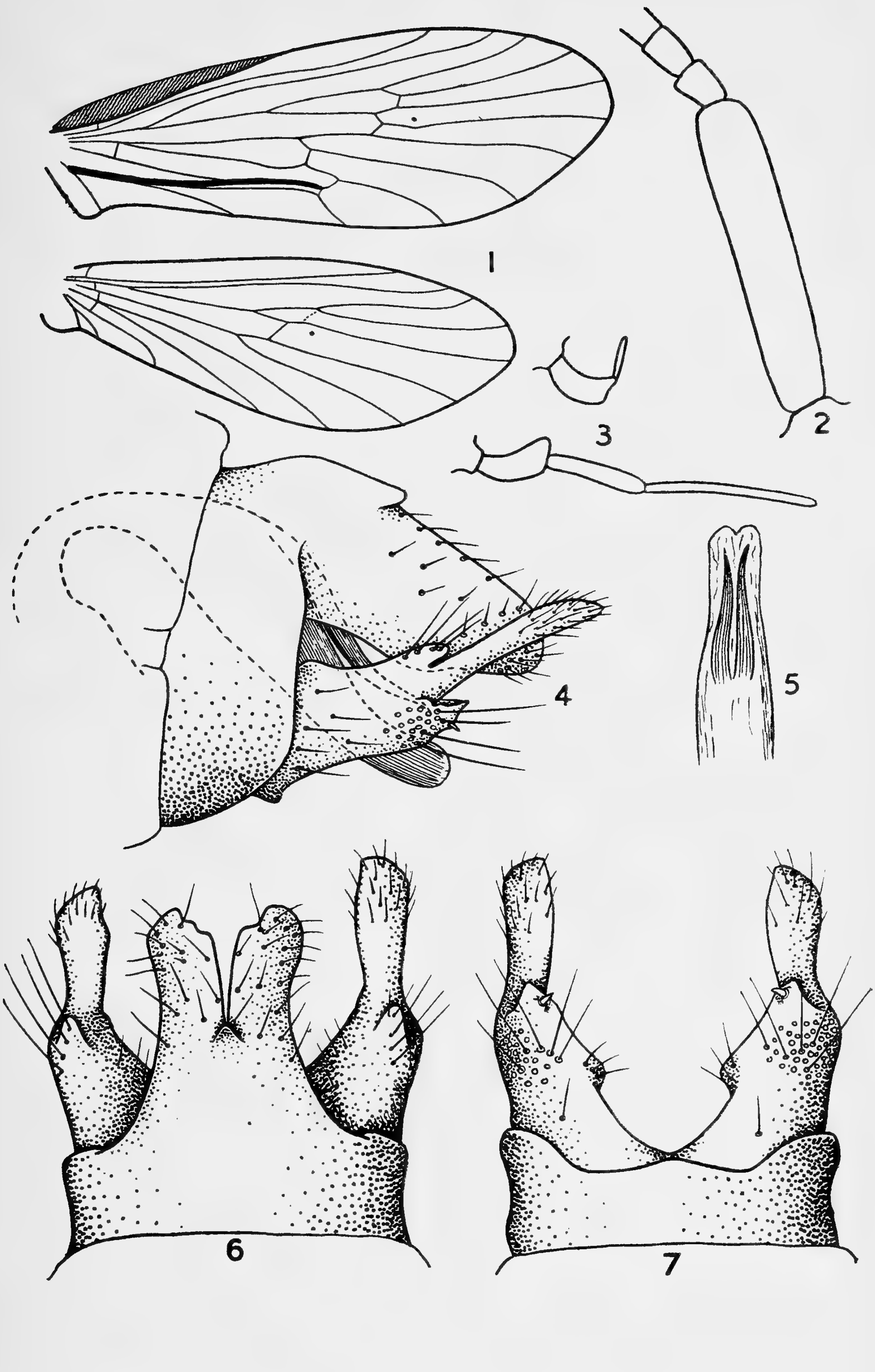
Dinarthrena steelae sp. n. ♂. Fig. 1, wings. Fig. 2, head. Fig. 3, genitalia dorsal. Fig. 4, lateral. Fig. 5, ventral. Fig. 6, wings, ♀.



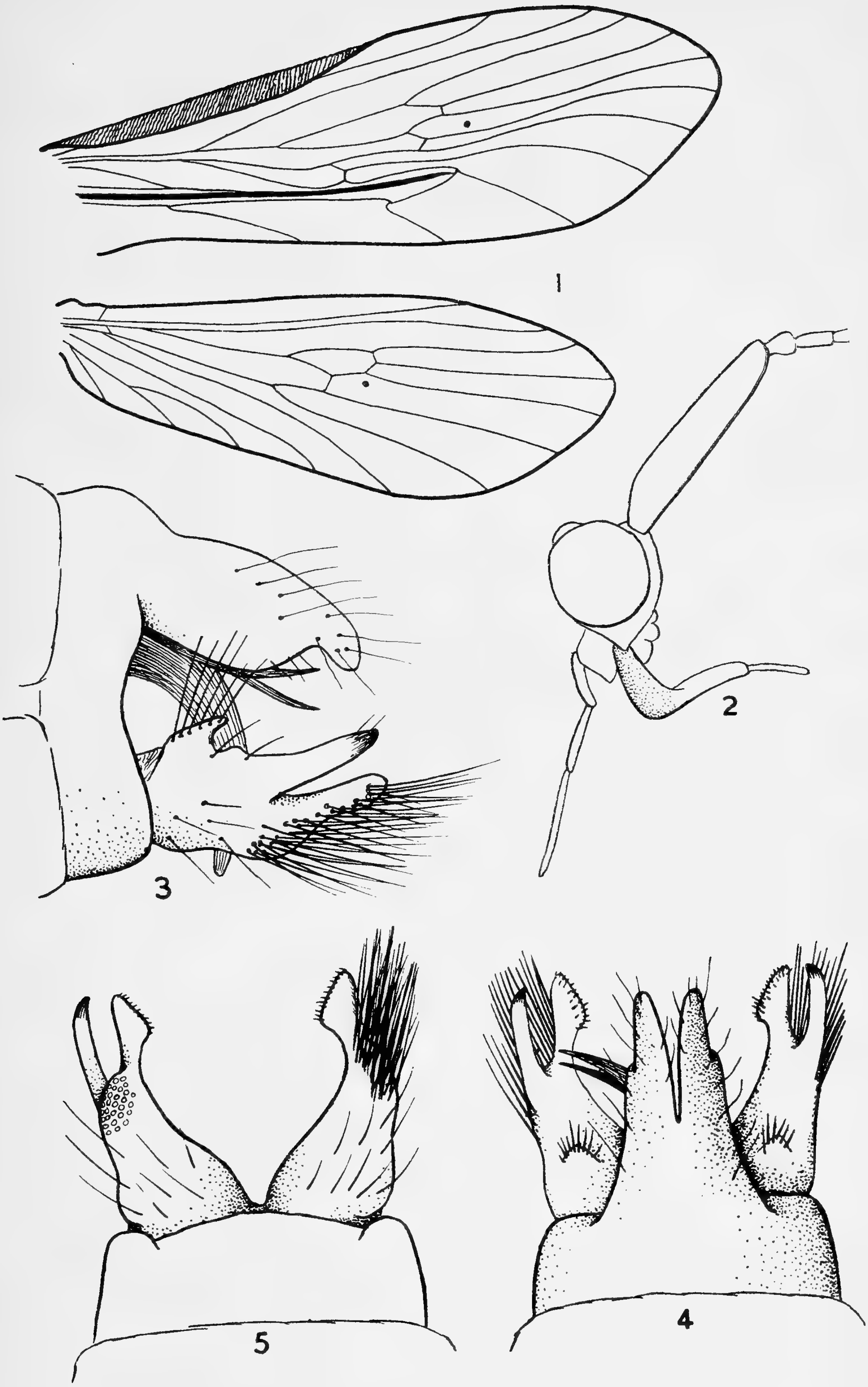
Agoerodella punkata sp. n. ♂. Fig. 1, head. Fig. 2, anterior leg, dorsal. Fig. 3, wings. Fig. 4, genitalia dorsal, penis omitted. Fig. 5, genitalia ventral, dorsal plate omitted. Fig. 6, lateral.



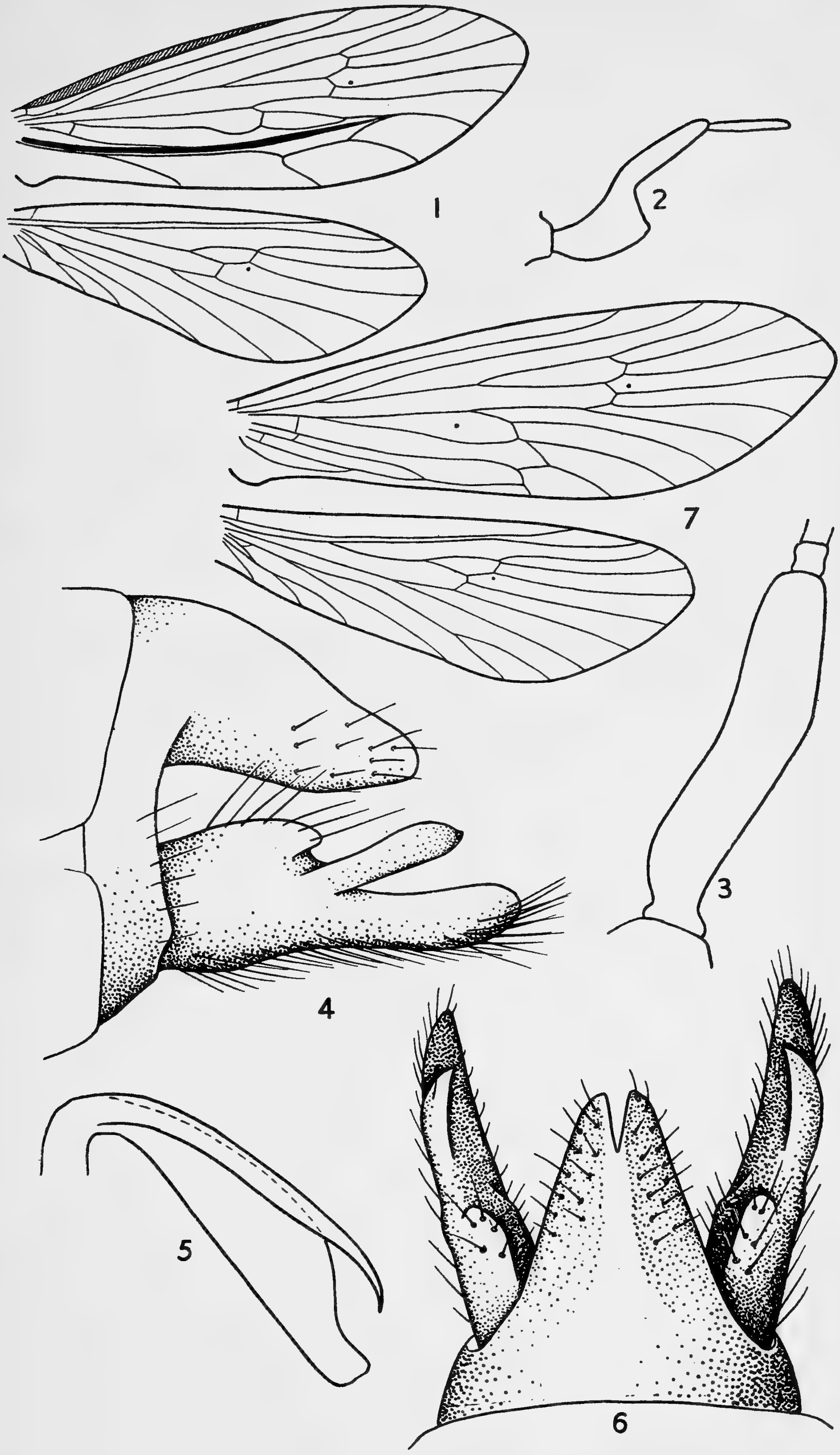
Adinarthrella brunnea sp. n. ♂. Fig. 1, wings. Fig. 2, head. Fig. 3, genitalia lateral. Fig. 4, dorsal. Fig. 5, ninth sternite and inferior appendages.



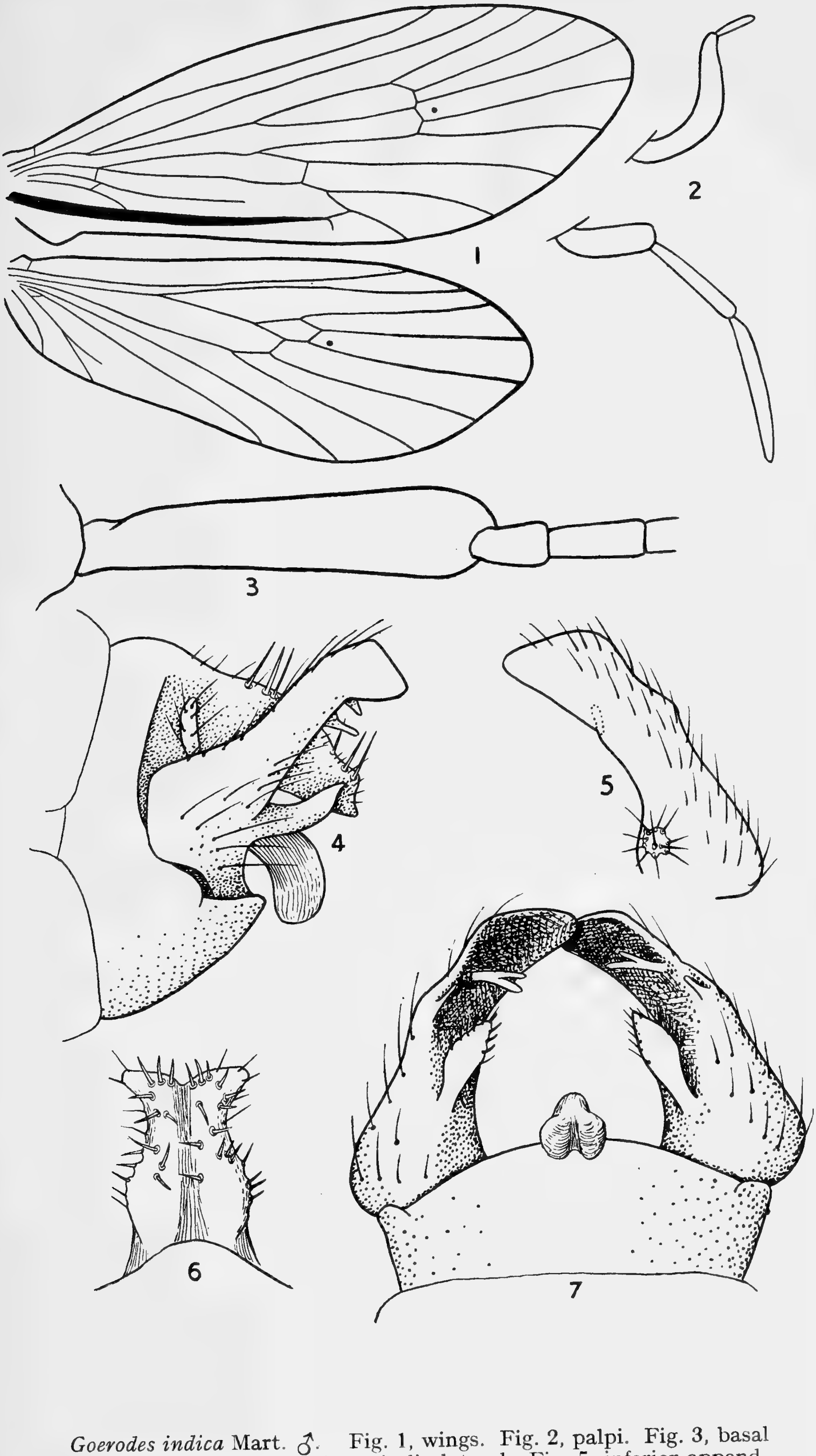
Adinarthrella inconspicua sp. n. ♂. Fig. 1, wings. Fig. 2, basal joints of antenna. Fig. 3, palpi. Fig. 4, genitalia lateral. Fig. 5, penis dorsal. Fig. 6, genitalia dorsal. Fig. 7, ninth sternite and inferior appendages.



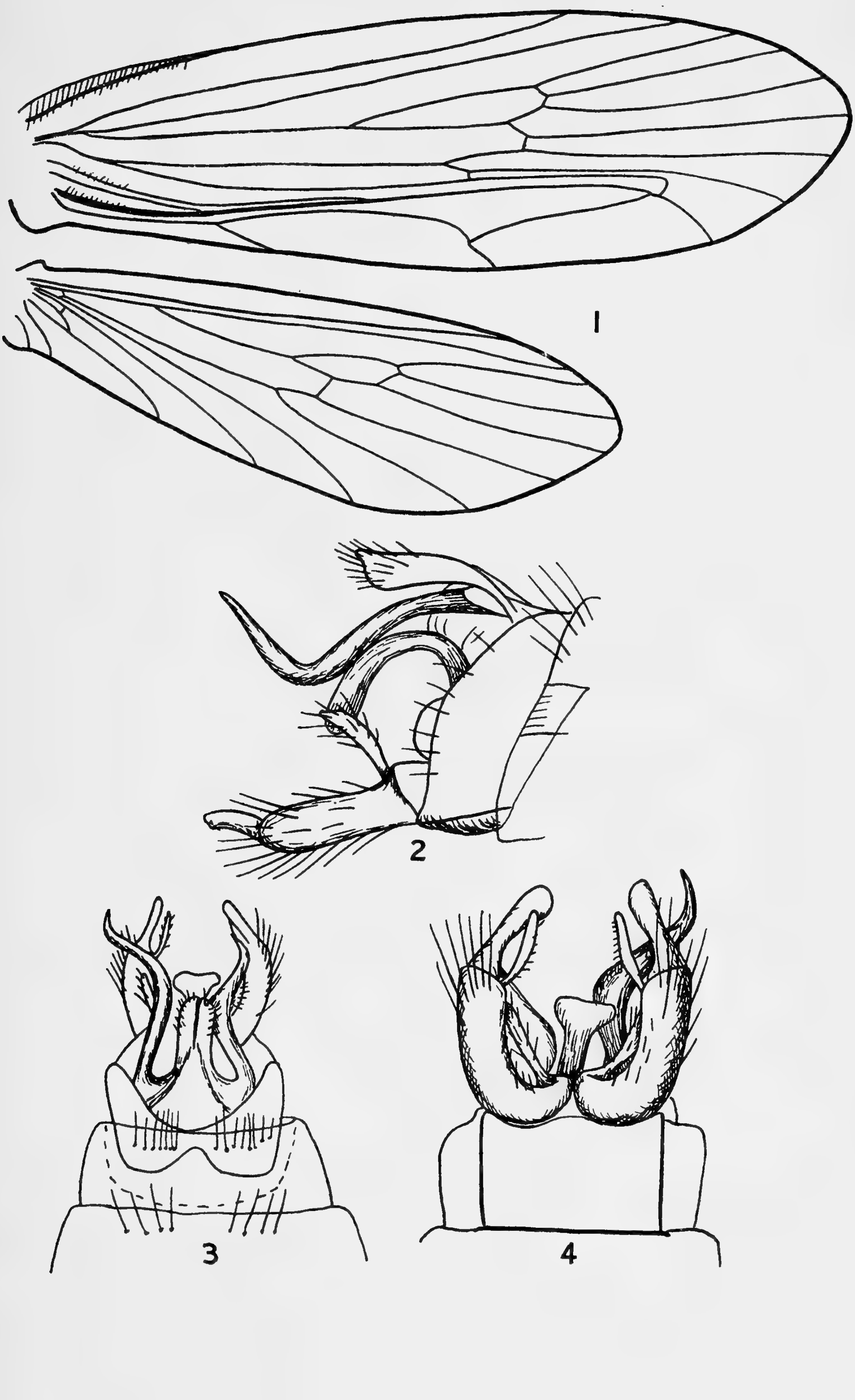
Adinarthrella kimsa sp. n. ♂. Fig. 1, wings. Fig. 2, head. Fig. 3, genitalia lateral. Fig. 4, genitalia dorsal. Fig. 5, ninth sternite and inferior appendages, bristles from one apex removed.



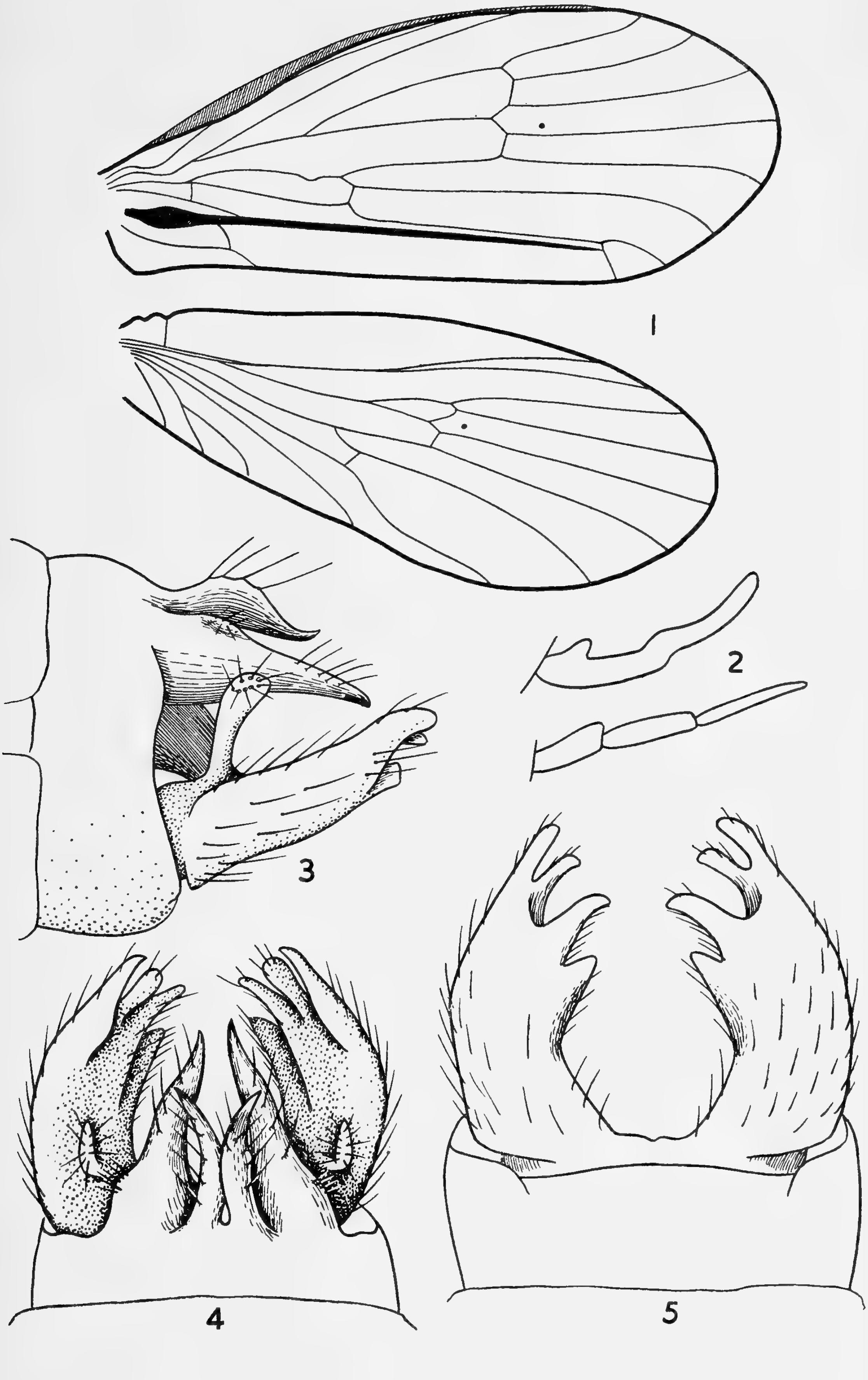
Adinarthrella parva sp. n. ♂. Fig. 1, wings. Fig. 2, maxillary palpus. Fig. 3, basal joints of antenna. Fig. 4, genitalia lateral. Fig. 5, penis and sheaths lateral. Fig. 6, genitalia dorsal. Fig. 7, wings, ♀.



Goerodes indica Mart. ♂. Fig. 1, wings. Fig. 2, palpi. Fig. 3, basal joints of antenna. Fig. 4, genitalia lateral. Fig. 5, inferior appendages from above. Fig. 6, dorsal plate. Fig. 7, genitalia ventral.



Goerodes inæqualis Mart. ♂. Fig. 1, wings. Fig. 2, genitalia lateral. Fig. 3, dorsal. Fig. 4, ventral. (After Martynov.)



Goerodes kanda sp. n. ♂. Fig. 1, wings. Fig. 2, palpi. Fig. 3, genitalia lateral. Fig. 4, dorsal. Fig. 5, ninth sternite and inferior appendages.

furrowed on its upper surface; inferior appendages very broad, five-branched; from beneath, four short branches are situated in the apical third, directed inwards and tailwards; the fifth branch arises on the upper surface of the appendage towards its base; it is short with a slender stem and clavate apex.

Length of the anterior wing ♂ 7 mm.

Ceylon: Mousakande, Gammaduwa, 19-24-xi-1933, Colombo Museum.

Type ♂ in the collection of the British Museum.

NOTES ON SOME INDIAN BIRDS.

BY

E. H. N. Lowther, M.B.O.U., F.Z.S.

(*With 8 plates*).

VI.—An Indian River-Bed.

(*Continued from page 777 of Vol.* xli, *No.* 4).

March gave place to April a fortnight ago, and already the heat in the United Provinces is such as to necessitate the closing of all doors, windows, and shutters, by 8 o'clock in the morning at the latest, the bungalow thereafter remaining in a dark and more or less air-tight state for some nine hours until the air without becomes cooler. 'Tis then that the coppersmith *tonks* his loudest and the koel repeatedly informs us *we're ill,* till we begin to think such really is the case. Unnecessary noises leave our nerves on edge; the sight of the cook with his *hissab* makes one itch to wring his neck; everybody and everything seems to conspire to make us thoroughly crossgrained, and we wonder 'if we had only known before that it was going to be like this' whether we would have come out to India to earn our living.

Although, with the advent of the hot weather, such thoughts annually assail many of us, the true bird-lover is not rattled by the rising thermometer; rather does he welcome the arrival of April, because he knows it is during the next three or four months that the nesting season in India reaches its peak. On all sides now—except at the *jhils*—there is plenty to interest him, nowhere more so than on the bare sandbanks in our large rivers where, already, the little pratincoles, skimmers, and the different species of terns and plovers are nesting. In spite of the fact that a visit to the breeding haunts of these birds means braving a relentless sun, and is made with the knowledge that we are going to be well 'cooked' long before we are back home again, we decide that we cannot let the month pass without seeing again how the several river-bed birds are faring. But whereas formerly we made the rather tiresome journey to the river in the early morning, we now go overnight, so as to be on the scene of operations with the first blush of dawn. Thus we not only conserve our energies—*very* necessary as we grow older—but are likely to see far more of interest during the early hours of the day. Nor is this all: between 6 and 8 a.m. the light is more favourable for photography in the river-bed than during the remainder of the twenty-four hours. And so, having dined well, we proceed about ten miles by car; then, boarding a small boat, are rowed some five or six miles up the Jumna, a full moon making our passage through the shallow channels easier, and showing up an occasional country boat laden with ballast or fodder, anchored for the night. Not a

human sound is to be heard, though other noises keep us awake for a while. The croaking of frogs never ceases—a sure sign we have had rain recently; now and again spur-winged plovers or red-wattled lapwings leave the small islands on which melons are being grown, and where their nests are, to circle over the boat, rending the night with their piercing alarm notes. At this late hour we can note more accurately than is possible during day-light the difference between the notes of the two species: how the former's call is neither so frequently uttered nor so penetrating as that of the *did-he-do-it* bird. Then, as we soliloquise, jackals ululate from the river's bank; which makes us communicative too. Asked for his views concerning the war, the *manji* (boatman) holds forth on the Hindu-Muslim *larai* (war). Questioning him further we learn he has not heard that the Empire is at war with Germany; this inspite of the fact that he lives within ten miles of the *de jure* capital of the United Provinces. Surprising though this may seem, the incident is not without parallel in our experience. We recall a friendly talk round the Christmas camp-fire in a wild part of the Hazaribagh district in Bihar, when several of the beaters denied all knowledge of the Great War of 1914-18; which shows how little the masses in India are affected by Armageddon, so well are they cared for, in spite of its many imperfections, by the SARKAR.

It is soon after this 'discovery' that the batrachian chorus and the rhythmic beat of the oars lull us to sleep, but not before we have donned a cardigan and pulled a blanket over us, so chilly does it become on the water towards midnight even at this season of the year.

We tie up at our destination at 3 a.m., skimmers and terns protesting at this unwarranted intrusion of their haunts, but continue sleeping for another two hours. Then, as *Rosy-fingered Dawn, Child of the Morning*, appears, we step ashore and climb the right bank in order to obtain the best possible view of the sand islands below us, and to observe through the glasses the teeming bird life on them. A sight fit for the gods is presented to our astonished view, and as we regard it with bated breath we instantly feel as must that hushed throng have felt which gazed on Aeneas as he addressed Dido, the crowd whose bearing is so graphically described in the opening line of the Second book of the AENEID :—

Conticuere omnes intentique ora tenebant.

We cannot believe that so many birds or so many species can breed in such close proximity to one another: literally *hundreds* of Indian river terns, black-bellied terns, and little terns are sitting on their eggs, a duty which numbers of skimmers and little swallow-plovers are also performing. Many young birds too are to be seen running about the bare sand. Our pulses are quickened by the sight; and though we realise that to-day our time will be well occupied photographing the nests and eggs, as well as the young, of the several species, we decide we must attend to the

requirements of the 'inner man' before investigating matters further.

While breaking our fast with chicken cutlets, and bread, and butter, washed down with copious draughts of delicious iced coffee from the several flasks, we needs must observe the unceasing pageant of bird-life which passes before us. On the stake to which our boat is secured sits a pied kingfisher, watching the water below for some unsuspecting fish to appear near the surface. Something frightens the bird and it leaves its point of vantage, only, however, to quarter the river in front of us, bill pointing downwards and hovering in the air much like a kestrel. Twice it drops almost vertically, but when within a foot of the water, changes its mind, and rising, hovers once more, wings beating rapidly. Down it dives again—no half-heartedness about the plunge now—and this time the bird strikes oil, or rather a fish, and uttering a squeal of delight, flies off with the victim. A pair of large pied wagtails keep flying to and fro between our bank and the sandy islands, returning always with food in their bills. Investigation shows that they have a nest tucked well away under the exposed roots of a tree a little further up the river. This contains four large young. We learn later that *in* our boat is another nest of this species, also containing four well-feathered young birds. The parents have not accompanied us on our outing, so their offspring will have to remain unfed for some hours; which incident seems to indicate that the adults do not remain overnight with the young when they are a week or more old.

This discovery reminds us of a number of other large pied wagtails' nests we have seen on ferry-boats plying on the same river, and of the numerous occasions that we have noted the adult birds visit the old and dilapidated tubs when in midstream, in order to feed their young. Most nests of this species that we have seen, however, have been built on the underside of pontoon bridges, immediately over water.

Yet other birds we notice are sarus cranes, blacknecked storks, and a Pallas' fishing eagle. Normally the sarus is seen in pairs, or in family parties of three or four, according as to how the parents succeeded in hatching off their eggs, but at this time of the year numbers of these birds foregather on the banks of rivers, apparently for feeding purposes. To-day we count fifty-three collected together, and a wonderful spectacle *Antigone a. antigone* always presents, whether standing proudly or flying with slow, measured wing-beats, red legs and long neck outstretched, and uttering the loud trumpet-like call which is one of the most familiar sounds near *jhils* in many parts of northern India. The black-necked storks—a family party of four—are feeding not far from the cranes, moving about energetically in a shallow stretch. We note the manner of their progression, how the foot is first removed from the water by a slightly backward movement, then is raised and finally advanced clear of it, and not forced forward through the element as one might expect. Wonderfully handsome the parents are in their glossy black and snow-white plumage: how dowdy though are the young in their smoky brownish-black garments. The Pallas' fishing eagle flies from a large *pipal* tree

A Pied Kingfisher with food for its young.

standing back a short distance from the left bank. On it is the bird's eyrie which, to our knowledge, has been used every year for the past fifteen years, and, according to the villagers, for a very much longer period. Nesting duties are now over, and the young gone out into the world. We are impressed by the large size of the eagle, the yellowish-white colouring about the head and neck, and the wide white subterminal band in the tail, all of which, together with the loud clanging call, make identification easy.

The sight of the eagle reminds us of a visit made during an earlier year to the same place, when both birds were observed to swoop down again and again to the far end of the island, there to remain for short periods, all the time chased and mobbed by skimmers, terns, and plovers. Investigation later showed they had ravished countless clutches of these birds' eggs. No young ones were to be seen. Was this due to none being left or because they had not yet hatched out? We believe the latter was the case as what eggs remained were either fresh or only slightly incubated.

The Pallas' fishing eagle is not the only enemy of these river-bed nesting birds. Common or garden house crows, and even kites, plunder the eggs in exactly the same manner—indeed I possess quite a good photo of a pair of house crows at a skimmer's nest, one of them with an egg in its beak. Jackals too are partial to the eggs of terns and skimmers and not one escapes their attention when the birds have laid on a peninsula instead of an island. I am not sure the great stone plover does not also occasionally help itself to the eggs or young: of this more anon. The *manjis,* fortunately, do not seem to be interested in these birds' breeding arrangements.

In spite of the season being so late a small colony of sand martins is still engaged in nursery duties. By the margin of the far shore numbers of little stints—smallest of all waders—are feeding. Energetic creatures, they are constantly on the move in their quest for food. Often also they take to flight; at one time they appear to be all brown and the next moment all white, this depending on whether we see their upper or lower plumage as they 'bank'. On a spit of one of the islands some forty or fifty teal are attending to a leisurely toilet. Elsewhere Brahminy ducks stand in pairs, all suspicion and ready to take to wing for little or no reason, calling *honk-honk.* They, as well as the stints and teal, will soon be departing to cooler climes—in fact they ought to have gone ere this.

Closer at hand the fowls of the air whose nests, eggs, and young we shall shortly study, are going about their lawful occasions. River terns and little terns fly past us, upwind, twenty feet or more above the water, on the look-out for the tiny surface-feeding fish on which they live. As one is spotted, down the tern plunges, perpendicularly, or nearly so. If the dive is successful, the fish is either eaten, head first, on the wing, or is taken to the mate sitting on eggs. Each piece of water is quartered two or three times before the terns seek pastures new: frequently this is the same stretch but nearer the bank, or further out towards the middle of the river. Now and again the terns strike a shoal of

tiny fish; then, flying round in graceful circles, they help themselves freely at the banquet provided. At times, however, fish are apparently not to be found, or had easily. I have seen a little tern, with a fish in its bill, flying in the direction of its breeding ground five miles away. This I had just visited. There was no other nesting haunt in between. There can be no doubt that the fish was being taken to a sitting mate. Thus the capture of the fish, and the return journey to the nesting island, meant a flight of *at least ten miles.*

The black-bellied tern's feeding arrangements differ somewhat from those of the river and little terns. Certainly the bird flies over water and obtains much of its food from that element, but this seems to consist of insects more than fish, though the latter are also taken. It also hawks over the bare sand banks for what it may consume; in which respect its departure from the normal is similar to that of the white-breasted kingfisher which, even the casual observer will tell one, lives more on insects than on fish.

Identification of the different species of terns with which we are concerned here is, fortunately, a simple matter, size alone making this easy. Largest of them all—I do not include the skimmer, to which I shall refer presently—is the river tern; then comes the black-bellied tern, and smallest in size, the little tern. All have the tail long and forked; all have a french-grey upper plumage, with the top and sides of the head, and nape, black, the little tern in addition possessing a conspicuous white forehead. In the colouring of the lower plumage, however, the three species differ; while the under parts of the river tern are a greyish-white, the black-bellied tern's lower plumage, is either chocolate or black. The little tern has the under parts a chaste white. All three species have the bill yellow, though the depth of colour varies from deep yellow in the river tern to light yellow in the little tern, and orange-yellow in the case of the third species. The legs of the three species are also different in colour: the river tern's legs are red; those of the black-bellied tern orange-red, and of the little tern yellow.

I have said that size alone makes identification of the terns easy, and that the river tern is the largest of the three. But the river tern must not be confused with the skimmer which has a wider expanse of wing, and differs markedly from the terns in other respects also. It is a large black and white bird—much of the black is really a dark brown—with very long pointed wings. At rest, and above, when the bird is flying, the wings are black; viewed from below, the wings in flight are white. The forehead, the lower sides of the head, and from the end of the nape right down the back are white, as is the entire lower plumage and the tail, excepting the central feathers which are dark brown. The rest of the skimmer's plumage is brownish-black. It will be seen therefore that the skimmer is a very distinguished looking bird. Even more compelling than its plumage, however, is the bill. In size, shape, and colouring this is distinctive. It is large, somewhat arched, the upper mandible noticeably shorter than the lower. and a lovely shade of coral in colour, with the ends tipped yellow. Should the reader have the good fortune to examine a skimmer

A Little Tern brooding its eggs.

The River Tern—the largest of them all.

really closely, he will notice that the mandibles are closely compressed, so that they look like two fine knife blades set edge to edge. The reason for this highly specialised structure of the bill becomes immediately apparent if the skimmer is watched obtaining its food. The bird skims over the water with the beak wide open—it is amazing how the wings do not touch the water at all—the lower mandible cutting through the water like a plough, the upper one clear of it. Any fish or other food met with *must* run up the incline formed: there is no escape. In much the same way, in British railway practice, an express train locomotive picks up water, while running at a high speed, from troughs placed between the rails.

By 6 a.m. those skimmers which are not covering their eggs are collected in packs twenty to thirty strong, at the water's margin, there, except for occasional flights, or to relieve their mates, to spend the best part of the day, leading a thoroughly idle life. If we would watch the skimmer feeding freely and see the bird at its best we must visit its haunts late in the evening—the hour before sundown is the best time. Feeding begins again at the false dawn but lasts only a short while. Observation at this early hour is, moreover, difficult, and at best guess work. Even under the most favourable circumstances, however, it is difficult to determine what exactly is the nature of the skimmer's diet. Very small fish are certainly taken but my observations go to show this is not the staple food; indeed a skimmer usually holds a fish crosswise in its bill for such long periods, and toys so much with the wretched creature that I always feel it regards the victim with lack-lustre eyes. On the other hand I have seen a skimmer pass a fish over to another of its kind; the gift was promptly accepted though some minutes passed before any attempt was made to swallow the fish. More usually, it is my belief, the skimmer prefers insects for its food, and probably also small shrimps. One would imagine dissection should settle the problem, but apparently even this has not elucidated matters greatly as I see Stuart Baker states that the stomachs of those examined held nothing but a thick oily fluid.

The different species of terns, and the skimmers, naturally attract our attention most, but there are two other species that have their being on the sand banks, which we cannot fail to observe from our vantage point, though at this range we must use the glasses to see whereabout exactly is the main stronghold of the little pratincoles or swallow-plovers; these birds being the colour of the sand it is not an easy matter to pick them up with the naked eye.

The little swallow-plover has the upper plumage a sandy-brown with a black line close to the eye. The lower parts are white, including the tail which, however, is tipped black. There is some black and white in the wings which are long and pointed and give this small aberrant plover a swallow-like appearance in flight, though it is appreciably larger than any swallow. Much of the bird's time is spent in the air, both over water and sand, where it captures its insect food; in which respect it differs from the true plovers who obtain their meat from the soil. Lest it be

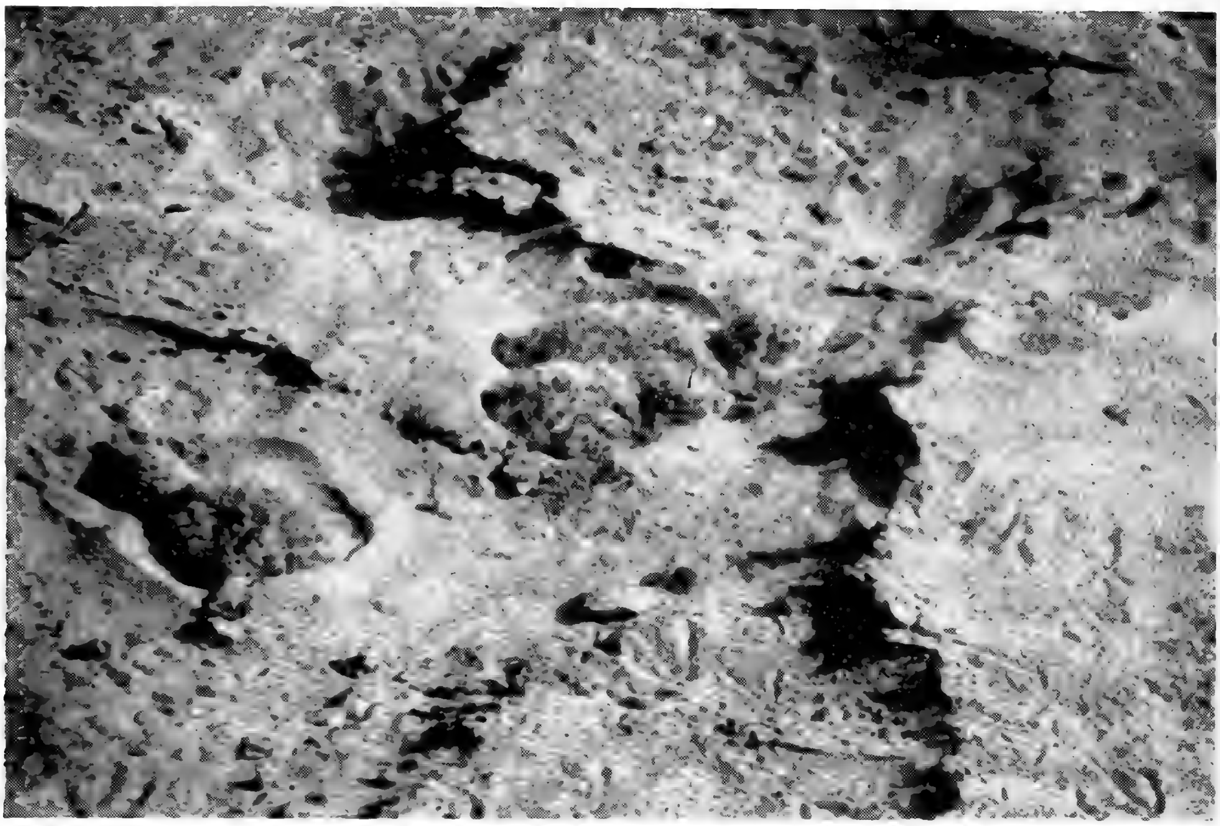
thought that the little pratincole does not obtain its meals from the ground also I hasten to add that it does, in considerable quantities, and possesses short legs which take the bird over the sand at a very creditable speed.

The spur-winged plover is of much the same size as the *did-he-do-it* bird, but possesses none of the self-assurance of that species. It has a small black crest, black head, chin, throat and bill, and a black band across the abdomen. The upper plumage is a greyish-brown, the under parts a greyish-white; there is a good deal of white in the wings and tail, and a black terminal band as well in the tail. Always—in the breeding season at all events—the spur-winged plover seems to be sneaking away from our direction, body and head lowered; always it appears wishful to avoid our gaze, as though it had committed some foul deed, and was now thoroughly ashamed of itself. It is strange that those very methods which the bird employs to escape our notice usually bring the spur-winged plover under observation. Not flashily clad, its alarm note is not so penetrating or interrogative in character as is the red-wattled lapwing's. It is usually a clear *did,* or *did-did.*

But we have tarried too long over breakfast, and must be up and doing if we would avoid the sun's fiercest rays, and the dust storm which is such a trying feature of the month of April. So, boarding the boat once more, we are rowed across to the largest of the islands, on which the different river-bed birds are breeding. As we land, river and little terns fly overhead, and make an appalling noise. Presently an unusually bold river tern swoops down on us repeatedly, without, however, actually striking us, its loud and rather drawn out note—*ping*—sounding like the scream of a bullet whistling past us. But before we have seen a single nest or young bird we halt to enquire the explanation for a number of holes going vertically into the sand. The *manji* tells us they have been made by the *goo-goo,* which lives at the far end of the burrows. Intrigued to see the creature, we have not long to wait, for, as the boatman pours some water down a burrow, up pops a remarkable looking cricket with a thick body some two inches in length, over which is a finely checked grey sheath. Over the tail is an object that looks like a watch spring. On either side of this is a single spike about a quarter of an inch in length. Other remarkable features are the very long, fine whiskers, the fierce-looking jaws, the prominent black eyes and the three sets of feet, all powerfully arrayed with spikes, the centre pair armed both fore and aft, the leading pair in front, and the trailing pair in rear. All these feet end in 'hands', used apparently first to dig up the sand or earth, and then to throw it away. The general colouring is light brown, with dark brown markings. The boatman volunteers the information that *goo-goos,* when matched against each other, fight to the death; that they are nocturnal in their habits, and those that return to their homes late are greedily snapped up by kites and crows. A reference to the Society, however, tells us that the *goo-goo* is less terrifying than its appearance, in spite of scientists having saddled it with the appalling name of *Schizodactylus monstruosus;* that it is a

The Little Swallow Plover hunts its insect food in the air or on the ground.

A Spur-winged Plover approaching its nest.



Baby Skimmers are even more difficult to detect than the eggs. They are indistinguishable from the indentations of crusted sand in which they lie.

A young Skimmer hiding after its first flight.

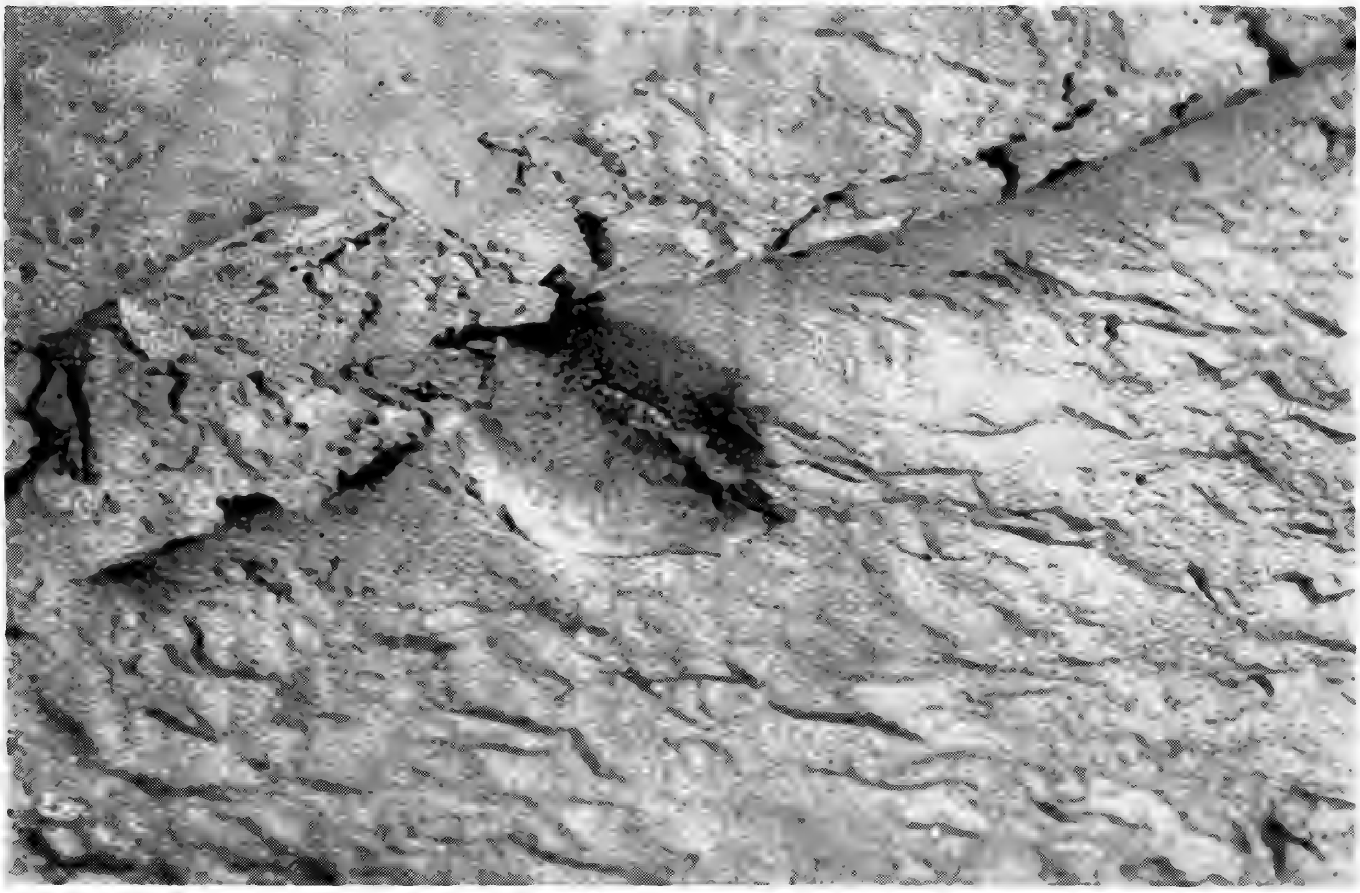
species of cricket which burrows into the sand banks in rivers, and into the loose soil in fields. We learn too that it occurs in the drier parts of northern and north-west India, and is described as doing a certain amount of damage to cultivation by cutting the roots of plants in the course of burrowing. Very little, however, is known of the insect's habits.

But we came not to study *goo-goos,* fascinating though these must be to the bug-hunter. Let us therefore press on and see what the teeming bird-life has to show. Ah! here's the first lot of eggs . . . Yes, three is the largest number I have known laid by any tern . . . Not much of a nest, is it? . . . The eggs lie on the bare sand. House furnishing is a very simple matter, all that the female has to do being to turn round once or twice, the circular depression so formed serving as a nest. Sometimes, however, a few straws line the nest; particularly is this the case when the eggs are laid near the water's margin, where the sand shows signs of remaining damp . . . Judging by the size of the eggs, and the greenish tinge in their ground colour, I should say this clutch is the property of a pair of river terns. The skimmer's eggs are about the same size as the river tern's, but are invariably of a buff or stone colour. However, eggs of both species are commonly similarly coloured, so that identification is by no means always easy. The only certain method of identifying the eggs of the river tern and skimmer is to watch the parent bird to the nest . . . All terns and skimmers' eggs are spotted or blotched with dark brown or reddish-brown markings on the surface, with under-lying patches of a purple shade. In the case of the little tern these markings frequently form a pronounced band about one-third the way down the egg, though the remainder of the egg is also marked . . .The eggs blend astonishingly with their surroundings . . . *More* nests? Yes, of course, skimmers and all these terns are very colonial in their breeding arrangements . . . Hereabouts all three species of terns are nesting together, hopelessly mixed up. Not many black-bellied terns though—they always seem to remain somewhat aloof. At other times territory appears to be carefully parcelled off, so that each species keeps to itself. The eggs are seldom deposited on the bare expanses of fine, glistening sand; usually the nests are made along the ridges left by the receding water at the close of the previous monsoon . . . A clutch of *four* eggs? . . . Without doubt they are a skimmer's. Every year I happen on one or more clutches of *five* laid by this species. . . *Hullo! eggs sprinkled with water . . . More* treated in this wise?. . . From mid-April onwards, when the sun is well in the heavens, I usually come across eggs, and young birds too in the down state, sprinkled with water. I suppose the parent birds do this to prevent the eggs being baked . . . Just put the back of your hand on the sand . . . Wickedly hot, isn't it? . . . Ah! some young birds . . . Sandy-brown in colour with buff markings on the head and back . . . Lying stretched out full length, as flat as pancakes, and not moving a hair, they are even more difficult to distinguish from their surroundings than are the eggs, particularly when they rest in indentations in the 'crusted' sand. These are baby skimmers. Young terns have the down a

richer brown, and are more heavily marked about the head and body . . . I wonder when the young skimmer's bill becomes shaped like, and assumes the colour of, the adult's? Certainly not before it has learnt to fly. At this age the young skimmer's bill and feet are of a horn colour. The bill has assumed, more or less, the shape of two knife blades placed edge to edge, but the two mandibles are of much the same length, and the upper is not yet arch-shaped. Now we are approaching the breeding territory of the little swallow-plovers . . . Becoming a bit excited, are they not? Yes, as they flutter about before us, every single one apparently either with legs or wings broken, they look as though some sportsman (*sic*) had 'browned' them. Actually they are as hale and hearty as either of us. They have eggs or young, and this is their method of decoying us away from their treasures . . . No good your chasing the birds, Pokhi. Look about for their eggs instead . . . We must be right on the spot now—the swallow-plovers are almost dancing on their heads in their anxiety. Yes, here are the eggs—only two in each nest. At one time and another, I suppose I must have examined quite one thousand nests of this species, but only once have I seen one with more than two eggs—a clutch of three . . . Must be quite fifty nests hereabouts. Most of them on caked sand; some in the shelter of a small plant that looks like groundsel. Some in no nest proper, others in a slight depression. Like terns' eggs, those of the swallow-plover vary greatly in colouring, the ground ranging from light fawn to grey and pale green, with brown, reddish-brown and purple blotches, spots and pencillings superimposed . . . *There* are a couple of newly hatched pratincoles. Already they know how to lie low. What large gapes they have—rather like young nightjars. Clothed in grey down—different from the baby terns and skimmers . . . Here's an interesting find—a light blue-coloured egg of the little swallow-plover, and without any spots on it. I remember seeing a clutch of river tern's eggs similarly coloured. The species possesses notes which I would never have dared to attribute to it had I not heard and seen them uttered while inside a hiding tent photographing a little swallow-plover at the nest. Some sounded like the *tuck-tuck-tuck* call of the house lizard; others made me feel I was listening to a greenfinch singing . . . Look at that spur-winged plover on our left, sneaking away, *ventre à terre*. Its nest is probably alongside those derelict *bajra* stalks about thirty yards our side of the bird . . . As I thought, the four eggs lie in a noticeable depression, their pointed ends meeting in the centre. A real effort at nest building here, the eggs lying on several small pieces of straw. A favourite situation for the nest is among the melon beds on these islands. The owners do not usually demonstrate while we examine the nest. However, a member of this species once endeavoured to draw me away from its eggs by playing the broken wing game. It is a different matter when the spur-winged plover has young: then the parents show their anxiety by flying over us, calling the while.

We now make for the island's 'coast line', the ground there being firmer and walking consequently easier than over the soft

Like Terns' eggs, those of the Skimmer vary greatly in colouring.



A young Swallow Plover hiding.

A Little Ringed Plover comes to its nest.

'A little ball of fluff, mottled grey and brown above'
Little Ringed Plover.

sand we are traversing at present. We have not gone far when we see a little ringed plover running from inland towards the water's margin. About six inches in length and assimilating with its surroundings to a remarkable degree, the bird is always hard to spot and its eggs even more difficult to locate. I am confident, however, that the bird we have just seen has a nest; otherwise it would not have been such a distance away from the water. Mark carefully the place where we first saw the plover and look about ten or fifteen yards to the right, as the bird had probably run that distance before we spotted it . . . We search diligently, each step taken with the greatest care lest we crush the eggs. Soon they are found, within seven yards of where they were expected to be, lying in a depression of the 'caked' sand . . . Notice how the little ringed plover stands by the water, not uttering a sound but, every now and then, pretending to be searching for food. The bird's conduct is in strong contrast to that shown by another of the same species whose downy babes I once examined. Hearing the plaintive notes of an adult ringed plover and fancying these indicated the presence of young birds I commenced looking for them, my search made to the accompaniment of even more plaintive calling. As I examined her children—little balls of fluff, mottled grey and brown above and pure white below, wearing the inevitable 'collar' peculiar to baby plovers and possessing conspicuous black-eyes—the parent ran close up to me and literally seemed to *beg* me not to harm her young. . . Nests of this species which I have found in the plains have never contained more than three eggs; in Kashmir all my nests contained four eggs.

Two personal experiences immediately come to mind in connection with the photography of the little ringed plover. The first concerns a *hide* which had been put up against a nest of this species on the left bank of the Chumbul river. I was inside the *hide* and my *shikari* had taken his departure, when the sound of heavy footsteps was borne in on me. Thinking the obtruder would soon veer off I remained quiet. The steps came nearer and before I could act, the *hide* and camera, to say nothing of myself, were knocked over by a cow which had come to graze off the branches, grasses, etc., stuck on to the outside of the tent for purposes of camouflage. The camera shutter was broken; so were the three eggs in the nest . . . The second experience produced far more satisfactory results to everybody concerned. I had taken a number of photos of a little ringed plover at the nest. The plates on development being found to be heavily over-exposed, I returned the following day to the *hide*—fortunately it had been left *in situ* over night—to correct my error. The ringed plovers were now very tame. Having made a few exposures I dismantled the tent and sat down less than five feet away from the nest, in full view of its owners. This made no difference to the birds who proceeded to incubate and even change places on the nest as though nothing untoward had occurred. During this session too I was to learn that birds sometimes continue to woo each other after the eggs have been laid. The male ringed plover not only courted his mate vigorously—rushing up to her with the lower plumage fluffed out—but indulged

in the sex act, the female leaving the three hard set eggs for the purpose.

We are now nearing the extreme end of the island. It was a fortunate thought that made us tell the *manji* to meet us here with the boat, for it is now 10-30 and the sun uncommonly hot. Before, however, we commence the journey home, we *must* (as we are so near) investigate that long, narrow limestone or *kanker* reef standing only two or three feet out of the water some two hundred yards upstream; it is just the sort of place where we may expect to find the great stone plover nesting . . . That tiny bird you nearly trod on then did not delay its departure for nothing . . . It was a Ganges sand-lark . . . *There* is the nest, a snug little affair, made of grass and fine roots, lined with vegetable fibres, tucked away in a small cavity in the ground where the great heat has cracked the clay soil till huge fissures appear. The nest contains three eggs, in general appearance very similar to miniatures of those laid by the large pied wagtail. How difficult it is to realise, even as we stand almost over it, that we are looking into a bird's nest. In this terrible glare the structure harmonises wonderfully with its surroundings.

Now we are in for it—here comes the sand storm. We can do nothing, situated as we are, except bear its full force. The sand will get into our mouths, our hair, down our throats, into our eyes and ears, penetrate everything, even the cameras in their cases and the loaded dark slides . . . I shall have to be more than careful when I take out the plates to develop . . . Ugh! how *beastly* it is crunching sand, and how it *lashes* one in the face . . . Every year I make up my mind never to bother again with these river-bed birds; every succeeding year they appeal with even greater force . . . Yes, I suppose there is no fool like an old fool . . . But *our* sufferings are nothing compared with those of the young skimmers and terns. After such a storm I have seen large numbers of these young birds practically buried by the drifting sand, only the tops of their bodies, heads and bills visible. However, they soon crawl out of their temporary tombs, the sand that still adheres bearing eloquent testimony to the discomfort they have suffered. On such occasions the parent terns and skimmers do overtime splashing water over their eggs and young. Many clutches of eggs also become completely buried; only the tops of others are to be seen. Matters are, however, soon put right and in a few minutes all the eggs again lie in neat, circular depressions.

The storm having spent itself at last, we board the boat to see whether our surmise is correct with regard to the nesting of the great stone plover . . . It *is*, by Jove . . . There goes one of the pair, running as hard as it can. It is a considerably larger bird than the stone plover, and essentially a denizen of the river bed, where outcrops of rocks, mingled with patches of sand, occur. The bird's most conspicuous feature is (to my mind) the bill which is shaped very much like a mortising chisel . . . Now the second bird comes into view—standing still, watching us. . . Very likely the female, and in all probability she has just come off the eggs. . . Here they are—beautiful objects, of a stone colour with bold dark brown blotches and underlying markings. . .

No nest worthy of the name really . . . Two is the full clutch . . . The egg is about $2.1'' \times 1.6''$ in size.

Earlier I hinted that the great stone plover may possibly be an egg-lifter, a baby-snatcher. I have very little to advance in support of this view and possibly the facts can also be used in argument against my theory; any way, here is the evidence for what it is worth. Passing a small island one morning, on which some driftwood and small *babool* branches lay scattered about, I noticed river and black-bellied terns swoop constantly at something under one of the aforesaid branches. The glasses showed it to be a great stone plover; and a thin time old 'goggle-eyes' was having, judging by the manner in which he—perhaps she—I shall revert to this presently—flinched every time a tern dived at him. Obviously the great stone plover was incubating eggs, and equally obviously the bird was thoroughly scared. An hour later, on my return from a visit to a crested lark's nest, I waded out to the island. Now no mobbing was taking place, nor were there any signs of a great stone plover under the lopped off *babool* branch. A pair of these birds were, however, standing at the end of the island, each on one leg, looking the forlorn souls they often do. Past them flew an occasional tern, now taking no notice of the great stone plovers. Investigation of their nest showed that a tragedy had very recently occurred: the two eggs were broken, their yolks still drying in the sand. Did a tern smash them? or did the great stone plover itself cause the damage, exasperated beyond measure at being persistently mobbed, and having to incubate under such trying circumstances? Personally, I incline to the latter view. But *why* did the terns mob the great stone plover in such determined manner before, when now they took no notice of the birds? We can only speculate as to the reason, but the impression that was created in my mind at the time still remains to-day, that the great stone plover had been caught in *flagrante delicto* filching an egg or young bird, and the terns were determined that Justice should be done.

Somewhere I have read that only the female great stone plover incubates. This may be the case generally but it is not the invariable rule. At the one and only nest on which I have succeeded in photographing this species, the 'change over' took place three times during the course of two days. Certainly the bird which I took to be the female incubated for long periods, but on one occasion the male (presumably) sat continually for a little over two hours.

This brief study of the great stone plover concludes the list of breeding birds we may normally hope to study when visiting a river-bed. There are, however, two other species I constantly meet with when proceeding to the nesting haunts of skimmers and terns; not that the nests of the two species referred to are not found also in localities far removed from the neighbourhood of our large rivers, because they are, the wire-tailed swallow's sometimes even in the verandahs of our houses, and those of the cliff swallow under the arch of a canal bridge. But the cliff swallow's nesting site, *par excellence*, is the high bank of a river, such as the Jumna or Chumbul. These high banks are cliffs to all intents

and purposes, and are a feature of parts of the Agra and Etawah districts, through which these rivers flow. Similarly the nesting of the wire-tailed swallow is associated in our minds with shelving rocks, whether these be on the river's bank, or piled one on another in mid-stream.

Never shall I forget my first glimpse of the nests of the cliff swallow. I was on the right bank of the Chumbul and noticed, upstream, on the face of the left bank, something that looked like a large map of India. Due to the shimmer that was coming off the sands I was unable to tell, even with the glasses, what the 'map' was. I therefore waded across and in due course investigated matters. The 'map' turned out to be between two and three hundred nests of the cliff swallow! They looked just like so many carafes, their bases stuck to the cliff face, the mouths of the bottles protruding towards the river. *What* a scene of activity pervaded the colony—birds flying in and out of their nests the whole time, feeding the young, twittering the while. The ubiquitous sparrow had taken possession of a number of nests, and where this was the case the tubular entrances were broken away in varying degrees.

A beautiful and striking bird is the wire-tailed swallow, with its bright steel-blue upper plumage, chestnut-capped head, spotless white under-parts and long wire-like outer feathers some seven inches longer than their companions. The nest of this species, a shallow, pellet constructed affair, lined scantily with dried grass and a few feathers, and containing up to three eggs, ground colour white, with reddish-brown spots and speckles, mostly collected round the broad end, is commonly attached to the under surface of a sloping rock, sometimes only a foot or two above water.

I cannot conclude this article without some reference to the photography of river-bed birds. A *hide* placed in the tree tops is quickly accepted by spoonbills, cormorants, etc. as part and parcel of the tree in which their nests are located, but the sudden appearance of a hiding tent on a large sandy island is regarded with disfavour by terns and skimmers, even though at first this is placed at some distance from any nest. This suspicion of the *hide* is only natural, as whether it is erected to look like a bush, or a large pimple or wart in the sand, the creation is, to say the least, something quite out of the ordinary on what, after all, is a bare desert island. With the river-bed birds, therefore, the photographer starts at a disadvantage. But this is not all. The west wind, or *loo,* which blows throughout April and the first half of May, the principal breeding season of the terns, skimmers and swallow-plovers, literally speaking *rocks* the *hide,* no matter how deep the uprights go into the sand, or how tight-fitting on its frame is the canvas work. Every bird-photographer knows there is nothing that alarms a sitting bird so much as movement of the hiding tent. And what shall I say of the heat inside the *hide*? This is greater than anything one can conceive. Many a time, on crawling out of the tent after photographing a tern or swallow-plover, blinded with perspiration and almost in a state of collapse, have I felt, on exposure to the sun, as though I had suddenly been transported to the Arctic regions, so cool is it in

the open after the stifling heat within. I do not exaggerate the conditions; I merely state the facts so that the would-be photographer may know what he is up against. But if the obtaining of pictures of skimmers and terns is attended with difficulties, the photographer is, at all events, a constant spectator of most interesting and exciting episodes in the bird-life around him, as the following extracts from my diaries indicate:—

'From time to time I am a silent witness of the most affectionate intimacies in the lives of these birds and cannot help feeling a horrible Peeping Tom. One little tern brings a small fish which it holds proudly and delivers to its sitting mate, to the accompaniment of much loving chit-chat on the part of both birds. A photo of such an incident might well be entitled "From the Bridegroom to the Bride". Sometimes, after presenting the fish, the donor proceeds to incubate the eggs, while his mate flies off; at others, on the approach of her mate, the sitting bird runs off the eggs to greet her husband, and having swallowed the fish, returns to incubate. Occasionally one bird relieves the other without first having presented it with a fish, and when this is the case I think it must be the female returning to the nest.'

'I have just witnessed a most amazing incident. A little tern arrived at one nest with a fish in his bill, and the bird's movements indicated that he intended presenting it to his wife who, by her movements also, obviously anticipated receiving the dainty morsel. Instead he withdrew, and then strutted round his sitting mate three times, finally "treading" her on the nest; which done, he pranced round and round his wife again, and once more "trod" her, whereupon he presented her with the fish and then flew away. The nest holds three eggs.'

'A disappointing day so far but I have just seen something that compensates for a great deal. A young river tern—no young birds here are more than two or three days old—ran across the open sand and was about to pass a sitting skimmer when the latter left its eggs and attacked the young bird. The baby tern bolted in alarm, hotly pursued by the skimmer who tried to pick up the tot in its feet. At the third attempt the skimmer was successful in doing this and carried the little thing off, vigorously chased by a pair of river terns. All three birds twisted and turned during the hurly-burly, and eventually the skimmer dropped the ternling in the river. I feared the worst had happened to the mite but presently saw it heading for the island, on reaching which it at once went into hiding.'

OCCURRENCE OF *SYNANTHERIAS SYLVATICA* SCHOTT IN THE BOMBAY PRESIDENCY, AND NOTES ON SOME OTHER *ARACEAE* OF INTEREST.

BY

CHARLES McCANN, F.L.S.

(With 4 plates)

Synantherias sylvatica Schott. *Gen. Aroid.* (1858)*t.* 28.

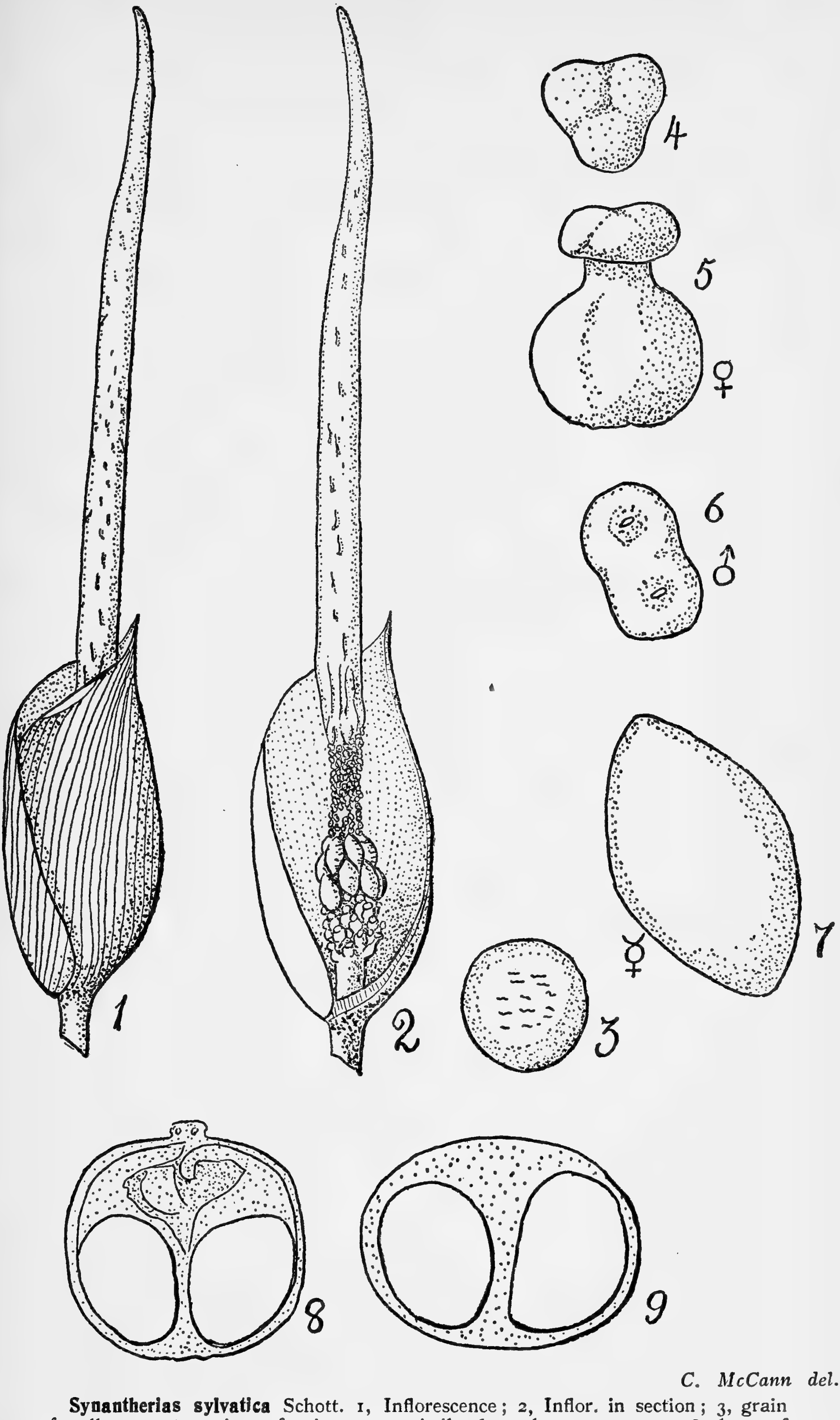
As far back as 1917, soon after I had commenced my botanical training, I had seen the leaves of an aroid which appeared different from the species I was familiar with. Perhaps I had seen the fruit also, but had mistaken it for that of one of the more common species of *Amorphophallus*—quite an easy mistake in this instance. The leaves were characteristic enough, but in the absence of the inflorescence, they could not be identified with any degree of certainty. I repeatedly tried to obtain the inflorescence, especially at the time when I made a special study of some of the local aroids, but without success. I visited the known habitat, Bhandup, Salsette Island, repeatedly in all weathers, but I seemed doomed to failure. The reason for the disappointment was obvious, I was not at the spot at the *right time,* a most important point when dealing with many of the aroids. Then again, weather conditions may retard or accelerate the flowering period.

Some years ago, I was in the same locality towards the end of the rains and I came across a number of the plants in leaf. The old longing to solve the problem of this baffling aroid returned, and so I brought some of the plants home and planted them in a pot in my garden. The corms leafed regularly every year at the break of the monsoon, but never flowered. The reason for this non-flowering was obvious to me, the corms I had brought were not yet large enough—this fact is common to many species of the order. At last, towards the end of May 1941, an inflorescence appeared in the pot, and on the 24th of the month was fully open. It was *Synantherias sylvatica* Schott, a plant excluded by Cooke[4] from the *Flora of the Bombay Presidency.* At long last, almost after a quarter of a century I was able to fix the identity of this illusive aroid! Elated with my 'discovery', I sat down at once and worked late into the night to complete the accompanying drawings. Next morning I made the colour notes and took the necessary measurements before setting off for work. No rain had fallen up till now.

On the 3rd June there were a few showers with all the signs of the approaching monsoon. On the 4th I visited Bhandup with the sole purpose of obtaining further material for examination and preservation, thinking that *Synantherias,* like *Amorphophallus,* flowered soon after the first showers. This was precisely my mistake all these years. Most of the inflorescences I now found were already in well advanced fruit, which clearly indicated that the former flowered some time before the rains.

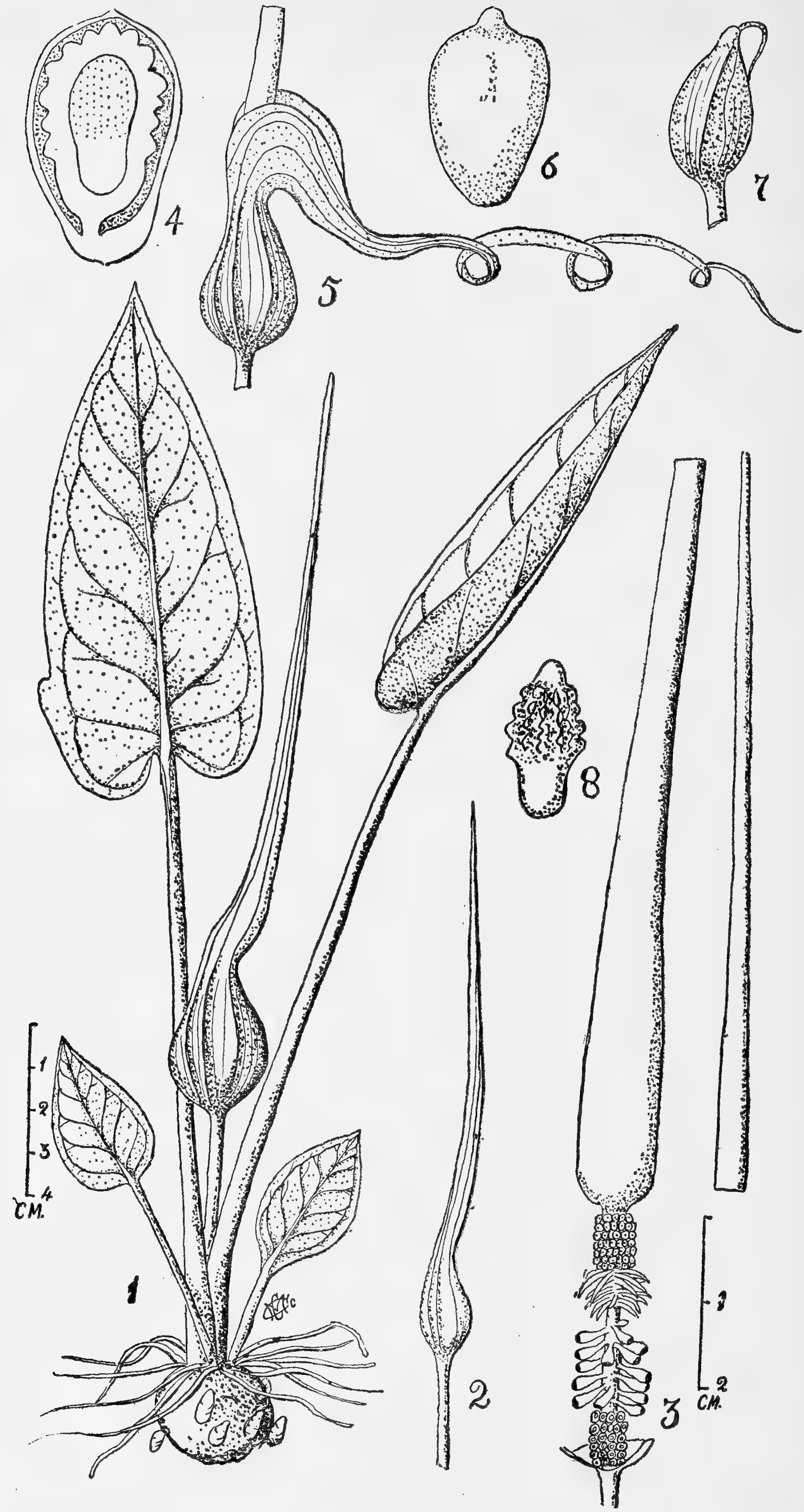
In the *Journal B.N.H.S.,* xxxv, p. 29, Blatter and I recorded the occurrence of this species in the Presidency from a sheet in the Herbarium of the Economic Botanist, Poona, from Bedoli, N. Kanara. The date on the sheet 'Sept. 1893' indicated that it flowered in September. Likewise there is a reference to the flowering period in Trimen's flora as 'September 1885.' Why there should be this difference between the Kanara and Ceylon specimens and the Salsette plants I fail to understand. *Amorphophallus* generally blooms only after the first showers of rain. Another point of difference between the two genera is that the corms of *Amorphophallus* either flower or leaf in the same season, but do not do both in the same season, whereas the corms of *Synantherias* flower and then bear leaves in the same season—a point worth consideration.

Authors appear to be undecided as to whether this plant should be considered as a species of *Amorphophallus* or be treated as a member of a separate



C. McCann del.

Synantherias sylvatica Schott. 1, Inflorescence; 2, Inflor. in section; 3, grain of pollen; 4, top view of stigma; 5, pistil; 6, anther; 7, neuter; 8, l. s. of fruit; 9, t. s. of fruit.



Typhonium flagelliforme (Lodd.) Blume. 1, entire plant; 2, bud; 3, spadix; 4, T. S. of bacca; 5, open flower; 6, seed; 7, tube of spathe in fruit; 8, seed.

genus, *Synantherias* Schott. Hooker[2] (1893) considers it as a species of *Synantherias*; Cook[4] (1908) follows Hooker; but Fischer[5] (1931) considers it as a species of *Amorphophallus*! In the absence of firsthand knowledge of the plant Blatter and I[7] followed Fischer when revising the *Araceae* of the Presidency, but in the light of my recent observations I feel that *Synantherias* should be retained as a separate genus.

Blume created the genus *Amorphophallus*, and according to the works I have at my disposal, distinctly says, 'neuters o'. 'In *Synantherias* neuters are present. Hooker[2] under the generic characters of *Synantherias* writes, 'Characters of *Amorphophallus*, but male and fem. infl. distant, with oblong depressed interposed neuters.' Fischer, 'Neuters o or few.' This appears a departure from Blume's definition. I do not know of any of our species of *Amorphophallus* in which neuters are present. Therefore, as neuters are present in *Synantherias* I consider it worthy of generic rank. Coupled with the presence of the neuters is the absence of a distinct limb to the spathe. Then again, there are the two field characters already referred to, namely (*a*) the earlier flowering period, and (*b*) the production of inflorescence and leaf by the same corm in the same season—both physiological character, perhaps of some importance. The size of the leaf or the inflorescence is relative to the size of the corm. Colour is also often a variable character. Though the general tones are similar there is much individualism, and it is also dependent on age, i.e. whether the inflorescence is fresh or old.

Measurements and colour notes taken from fresh specimens: Peduncle reaching 550 mm., dark green with lighter longitudinal markings, or pinkish with or without the markings, the markings when present are greenish brown. Inflorescence reaching 310 mm. Spathe 86×36 mm. dia. (when in bloom) similar in tones for the basal third as the peduncle then passing into deep purplish tones with or without markings. Internally, deep red-purple for the upper two-thirds, passing downward to almost black at the base. Spadix 305 mm. the flower-bearing portion reaching 59 mm., included within or exceeding the opening of the tube; appendage reaching 240 mm., smooth or slightly wrinkled, olive green or purplish-brown. Males purplish; female flowers at first creamy, the ovaries passing to green, the stigma yellow; neuters 14×14 mm. at first creamy, smooth, turning light earthy brown (like the skin of a potato) and finally becomes pinkish and somewhat rugose. The portion of the spadix bearing the female flowers alone enlarges in fruit. Fruit at first dark green then turning scarlet. Corm 80×50 mm. creamy or earthy brown.

Distribution.—'The Deccan Peninsula, from the northern Circars to the Concan, and southwards to Ceylon' (Hooker).[2] 'A native of the mountainous parts of the Circars' (Roxburgh)[1]. Cooke[4] mentions it under the 'Excluded Species' and gives the following reasons for its exclusion :—

'I cannot find any satisfactory evidence for the occurrence of this as a Bombay plant. [Engler D. C. Monog. Phan. v. 2 (1879) p. 320] gives Bombay as its habitat from the specimens in the Herbarium of Hooker and Thomson, which were however obtained from the Nilgiri Hills and Kurg, localities quite outside the Bombay Presidency. There is in Herb. Kew. a solitary specimen which was presented to the Glasgow Botanic Gardens by Mrs. Nimmo, but this is accompanied by no authentic note of locality and may have been collected anywhere. Woodrow gives Mārmāgāo in his list, but the Marmagao plant is *Amorphophallus commutatus*, Engl., which though quite distinct, has often been mistaken for this.

The plant occurs in S. India and is common in the drier parts of Ceylon.'

Localities: The only place where I know this species exists is at Bhandup, Salsette Island. It is very common in the area. Here it grows in the open among rocks or under mango trees. Elsewhere, I do not remember having seen the plant.*

Illustrations.—Wight's[8] table 802 though it certainly gives a good idea of the plant is a little defective in detail. The spathe, as far as I have been able to observe (I have examined several) does not fold over on the left side, but on the right. The spathe seldom opens to the middle (old fls.) it usually

* Since writing the above, I discovered this plant in leaf in the forest along the road to Vajrabai, near the Tansar river, on the 13th July 1941.

fits closely round the spadix. The neuters are not the correct shape. The details of the female flowers are not quite correct.

Note.—Both in the wild state and in my garden example I found species of small cockroaches (*Blattidae*) within the tube, but it was not clear whether these insects were just tenants, or whether they were concerned with pollination. The pollen is spherical, smooth and yellow.

Amorphophallus commutatus Engler.

On the 25th June 1934 I came across an outsize of this species on the banks of the Powai lake, Salsette Island. Some of the measurements are as follows:—Tuber 210 mm. across, and weighing 3 lbs. 10 oz. Cataphyl, the longest 365 mm. Spathe 420 mm. by 130 mm., rough within to the height of the male and female flowers. Appendage of spadix 420 mm., purple, tip subacute.

Typhonium flagelliforme (Lodd.) Blume.

I have had ample opportunity of observing this plant both in the wild state and in pots in my garden. To my detriment I introduced this plant into my garden. It is most prolific, the parent corm gives off innumerable small bulbils which give rise to new generations—it is a pest. The reason for this prolific propagation by budding was soon apparent. The plant flowers profusely, but does not set seed in proportion. It is the frequent infertility of the flowers which is counterbalanced by a generous tuber formation.

With regard to the colouration of the spathe there is a difference of opinion:—

Hooker[2], 'lurid red, papilose within.'
Cooke[4], does not mention this point.
Trimen[6], 'spathe 4-5 in., peduncled, green.'
Fischer[5], 'greenish, white or lurid without, red within.'

Strangely, very little is mentioned in any of the works of the colour of the other parts of the inflorescence. My own observations after several years are as follows:—Spathe at first pale green with a very narrow, faint purplish margin. The tube becomes intensely green with age, then yellows before it dies off. The limb is at first a translucent pale green turning whitish as it dies. The limb first falls away from the appendage, flat, then soon after becomes spirally twisted and falls back. The tube thickens, becomes strongly winged (ribbed)—a character omitted by most authors. Trimen being the only one who mentions this point. The neck closes tightly. The appendage is a pale sulphurous or orchreous yellow. Male flowers yellow; upper neuters white, lower neuters white with deep purple tips; females pale yellow turning greenish. In no instance have I found the spathe to be lurid or red in this species. Attention was drawn to this point in vol. xxxv, 22, of the *Journal*.

Trimen[6] has got the disposition of the neuters in his description all wrong—there are no neuters above the male flowers—all the neuters are between the male and female flowers. The subulate neuters are below the males and below these are the clavate neuters followed by the females as in the accompanying illustration.

Measurements.—Peduncle 95 mm. Spathe, tube 35 mm., limb 170 mm. Spadix, appendage 152 mm. ♂♂ 5 mm; upper neuters 8 mm. lower neuters 10 mm. ♀♀ 5 mm.

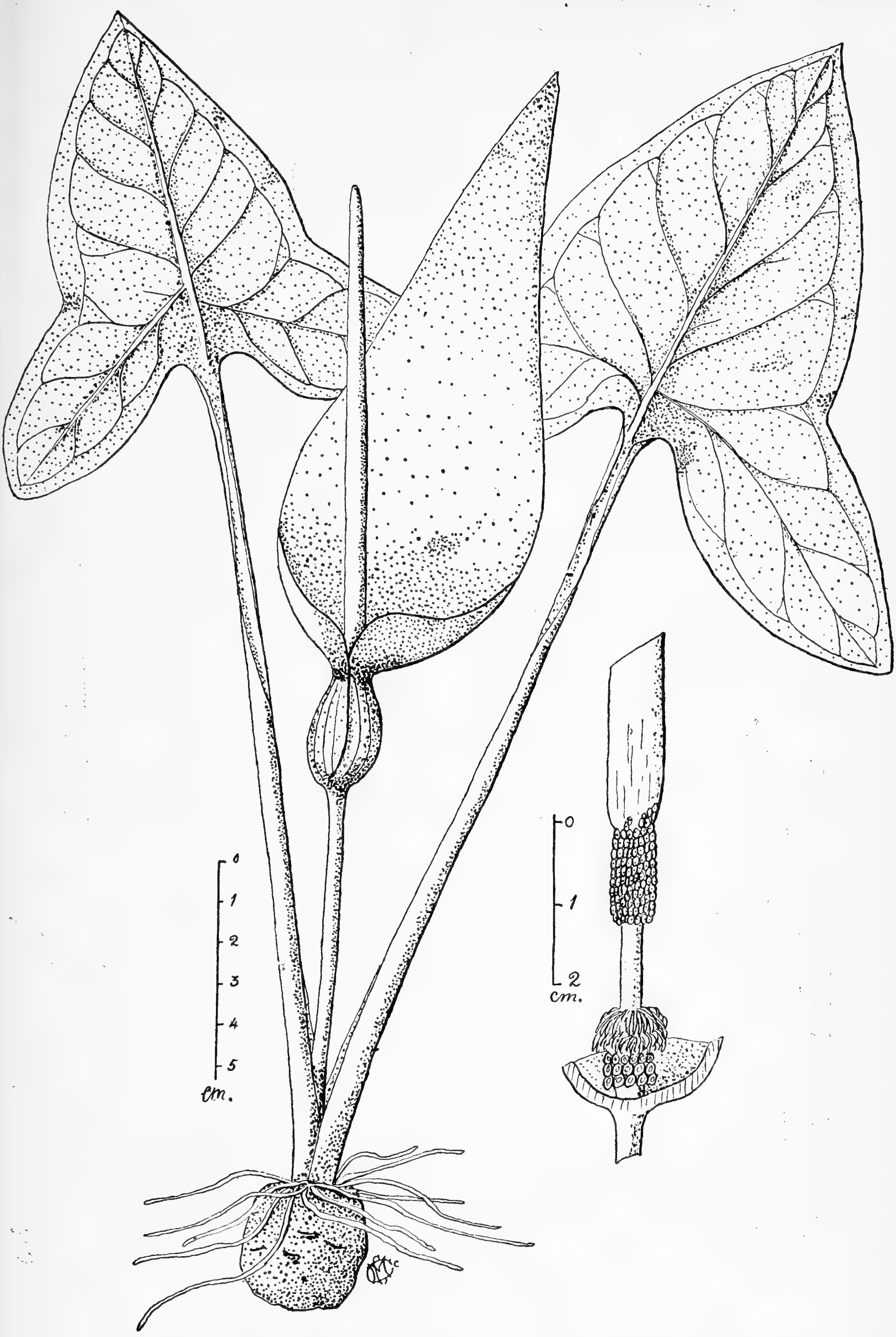
Illustrations.—Wight's table 791 is a figure of a robust plant with the inflorescences still in bud. The corm is too bulb-like.

Localities.—*T. flagelliforme* is an extremely common plant in some of the roadside gutters at Andheri often forming dense tufts. The plants continue to produce leaves as long as there is moisture. It flowers profusely in August and September, but may continue to do so later into the year.

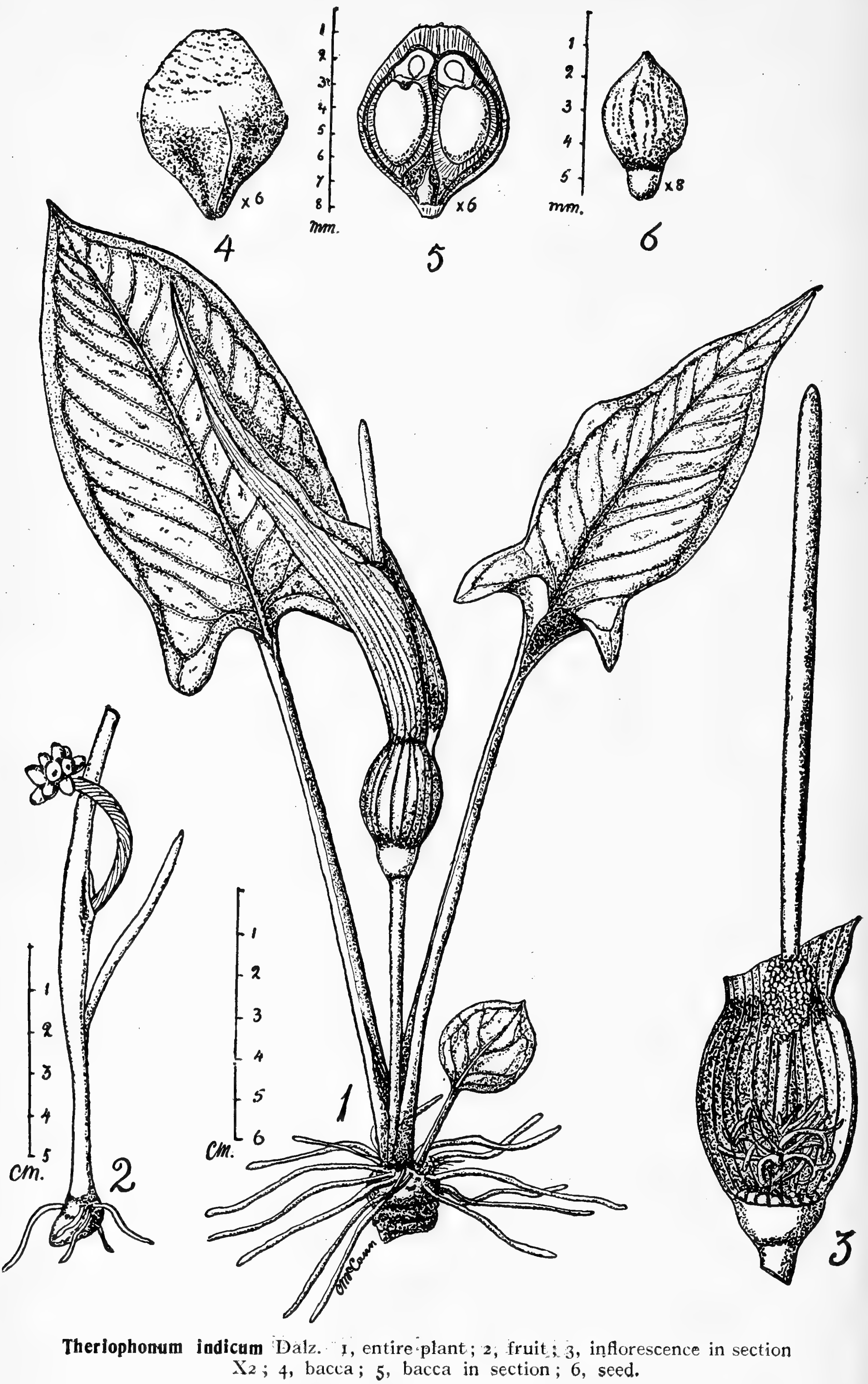
Typhonium amboinense Blatt. & McCann.

On the 21st June 1940 Mr. J. Jacobs, Secretary of the Prince of Wales Museum gave me a specimen of this species in flower which he had found in the Museum grounds. I saw a second specimen which was in bloom collected by Fr. Santapau in the grounds of St. Xavier's College, Bombay, during the month of May 1941.

The colour of the museum specimen was recorded as follows:—Spathe deep red-purple within, darker outside. Spadix appendage deep purple, male flowers



Typhonium amboinense Blatt & McC.



Theriophonum indicum Dalz. 1, entire plant; 2, fruit; 3, inflorescence in section X2; 4, bacca; 5, bacca in section; 6, seed.

pinkish; neuters yellow; females purplish. The spathe opens flat, but becomes twisted towards the tip as it gets older—a point common to the spathe of several aroids.

Wight's table 803 is the figure of a robust specimen. The corm is much too bulb-like. Comparing table 803 with table 790 there seems little to choose between, but a closer examination shows a difference; t. 803, *T. amboinense* has the neuters *recurved* whereas t. 790, *T. divaricatum,* portrays the neuters *erect.*

Theriophonum indicum Dalz.

This plant is common on the eastern faces of some of the Salsette Hills in the neighbourhood of Mulland. I have come across it at Borivli, but it is less frequent on the western side of the island. The leaves appear soon after the break of the rains followed by the inflorescence. Generally there is only a single inflorescence to each plant. The tube of the spathe is at first pale green, it then turns almost white. The limb is red-purple. Appendage of spadix purple. The leaves are very variable in size and may reach 300 mm. long, by almost half as broad.

In fruit the peduncle elongates and becomes twisted. The interval between the appearance of the flowers and the formation of the fruit is almost a month (22-7-'35 to 18-8-'35).

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A NEW FOSSORIAL SNAKE (*RHINOPHIS DORSIMACULATUS*) FROM CEYLON.

BY

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(*With one plate and one text-figure*).

The new snake here described belongs to the genus *Rhinophis* Hemprich, a genus restricted to southern India and Ceylon and representing one of the most advanced phases of fossorial adaptation in the suborder Serpentoidea.

In this genus not only are the head shields and tail strongly modified for such a habitat but the pigmentation is remarkable in that a number of species, particularly those from the more arid districts, display the reverse condition to that usual in ordinary snakes by being light dorsally, and dark ventrally. The variety of bright colors displayed by this family, the Uropeltidae, and the related Ilysiidae, affords a striking contrast to the sombre pigmentation of either the equally fossorial Typhlopidae, or some of Ceylon's fossorial lizards of the family Scincidae. Members of the family Uropeltidae are remarkably stenotopic, and the variety and abundance of the species of Rhinophis in Ceylon as compared with India, suggests that this Island is the original home of the genus from whence it apparently entered the sub-continent during one of the more recent Pleistocene connexions between the two countries. Six of the seven species recorded from Ceylon possess large caudal shields which are longer than half the shielded area of the head. These are further sub-divided into species in which the rostral shield is at least half the length of the shielded area of the head, and into those in which it is shorter. Another method of sub-division is by estimating the relative lengths of the rostral and parietals in fractions of the length of the frontal shield. When the species is not uniformally colored the easiest method of identification is by attention to pigmentation which is more or less constant for each species, but this is not possible in decolorized spirit specimens.

The large rostral and caudal shields and distinctive color pattern of black vertebral blotches along an orange dorsal band assist in the ready identification of the new *Rhinophis* for which the specific name *dorsimaculatus* is here proposed.

In Ceylon there are two recorded species with large caudal and rostral shields, the rostral being twice as long as the frontal or longer. In one of them, *R. punctatus* Müller, the frontal is as long as the parietal; in the other, *R. porrectus* Wall. it is only about two thirds (Wall *Snakes of Ceylon* 1921, fig. 13). The following comparison of these two species, as described by Wall, with the new form shows the relationships between the three. Features of interest in

the new species are its reduced number of scales and body length, the larger rostral, and the breaking up of the black vertebral band into blotches which might be regarded as signs of progressive specialization.

	R. porrectus	*R. punctatus*	*R. dorsimaculatus* sp. nov.
Frontal length in rostral length.	twice	twice	more than twice
Frontal length in parietal length.	two-thirds	equal	twice
Caudal shield length in shielded part of head length ...	three-quarters	equal	three-quarters
Number of ventrals ...	281	246–236	238
Anterior and posterior costal counts	19, 17	19, 17	17, 16–17
Body diameter contained in total length	76	49–47	43
Dorsal yellow band marked with dark vertebral ...	band	band	blotches

Rhinophis dorsimaculatus sp. nov., pl. I.

This snake is readily distinguished from other species of *Rhinophis* by the characters tabulated above. It is known from two specimens, in one of these

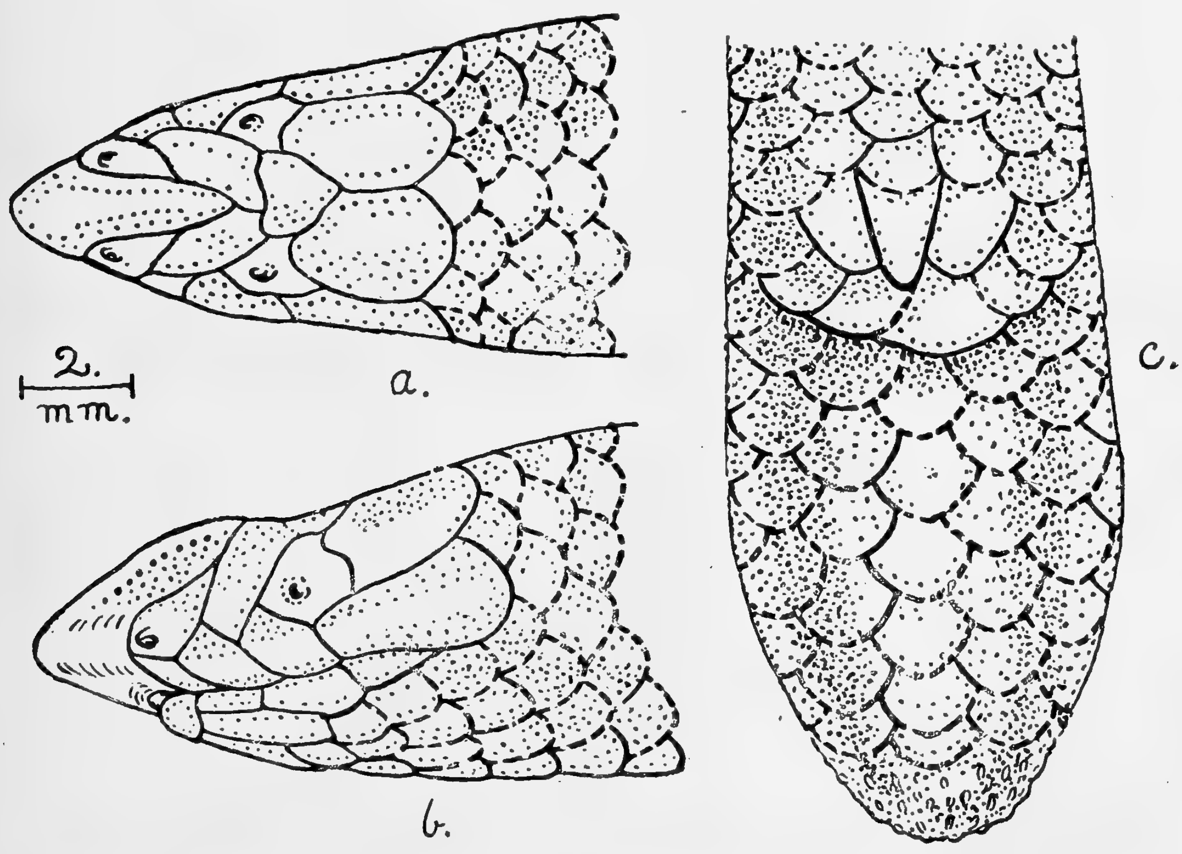


Fig. I. *Rhinophis dorsimaculatus* sp. nov. × $5\frac{1}{4}$ natural size.
(*a*) dorsal view of head.
(*b*) ventrilateral view of head.
(*c*) ventral view of tail.
P. Deraniyagala del.

the head is missing. The snake possesses a strongly arched, overshot snout and the body is not noticeably enlarged anteriorly.

Colour. One of the most conspicuously coloured snakes of Ceylon (Pl. 1). In the freshly preserved specimen the head shields are brown, suffused with bright orange. Dorsally there is a broad orange vertebral band occupying about five or six longitudinal rows, and in it the three more or less median rows possess black centres and form a zig-zag band for about five head lengths, after which it breaks up into a series of about forty black blotches, each larger than the head. The remaining body scales are black with yellow margins which form fine, zig-zag, yellow, longitudinal lines both laterally and ventrally. The sixth or seventh longitudinal scale row from the ventrals lacks black pigment as in a few other species of *Rhinophis*. The caudal shield is brown suffused with orange and possesses a dark 'U' shaped mark opening dorsally.

Pholidosis. Shielded portion of head slightly longer than caudal shield, rostral shield strongly carinate, arched, equals half the head length and completely separates the nasals; prefrontals contiguous and about twice as long as broad; frontal subtriangular as broad as long, is less than half the length of rostral and equals half the length of the parietal. Ocular about thrice length of pupil and somewhat narrowly in contact with frontal which it slightly exceeds in size. Supralabials four, the last being the largest head shield. Mental with a broadly rounded posterior margin, infralabials three, the second the largest; the suture between the first and second infralabials is under the suture between the second and the third supralabials, that between the second and third is under the suture between the third and fourth supralabials. The first row of post-mental scales is elongate and does not extend behind the anterior halves of the second infralabials (fig. 1*b*). Body scales as wide as long, subequal, 17 costals at two head lengths behind head, 17 or 16 at mid-body, ventrals 238 extremely feebly enlarged, preanals enlarged two or three in one or two rows, subcaudals entire 6, (fig. 1*c*), scales round caudal shield 12, caudal shield convex, rugose with numerous small tubercles and is about three-fourths the length of the shielded part of the head.

Dimensions. The type specimen No. 86 Colombo Museum, measures as follows:—length of shielded area of head 7.6 mm., diameter of body 8 mm., total length 350 mm., tail length 8.5 mm., width of frontal 1.7 mm., length of frontal 1.7 mm., length of rostral 3.8 mm., length of parietal 2.8 mm., interorbit 2.6 mm., length of gape 6 mm., caudal shield 6 mm. long 5.2 mm. wide.

Distribution. Known from two specimens, one obtained in February 1938 the other in March 1941 from the coastal village of Marichchukate, North Western Province, Ceylon. This area is unusually arid, and is of special interest in possessing such Indian dry zone reptiles as the scaly gecko *Lophopholis scabriceps* (Annandale), the sand boa *Gongylophis conicus* Russell, and the saw-scaled viper *Echis carinata* Russell.

In conclusion I wish to express my thanks to Dr. Baini Prashad, Director of the Zoological Survey of India, Indian Museum, Dr. A. Aiyappan, Acting Superintendent, Madras Government Museum, and to Mr. S. H. Prater of the Bombay Natural History Society for comparing photographs of this snake with the specimens in their collections.

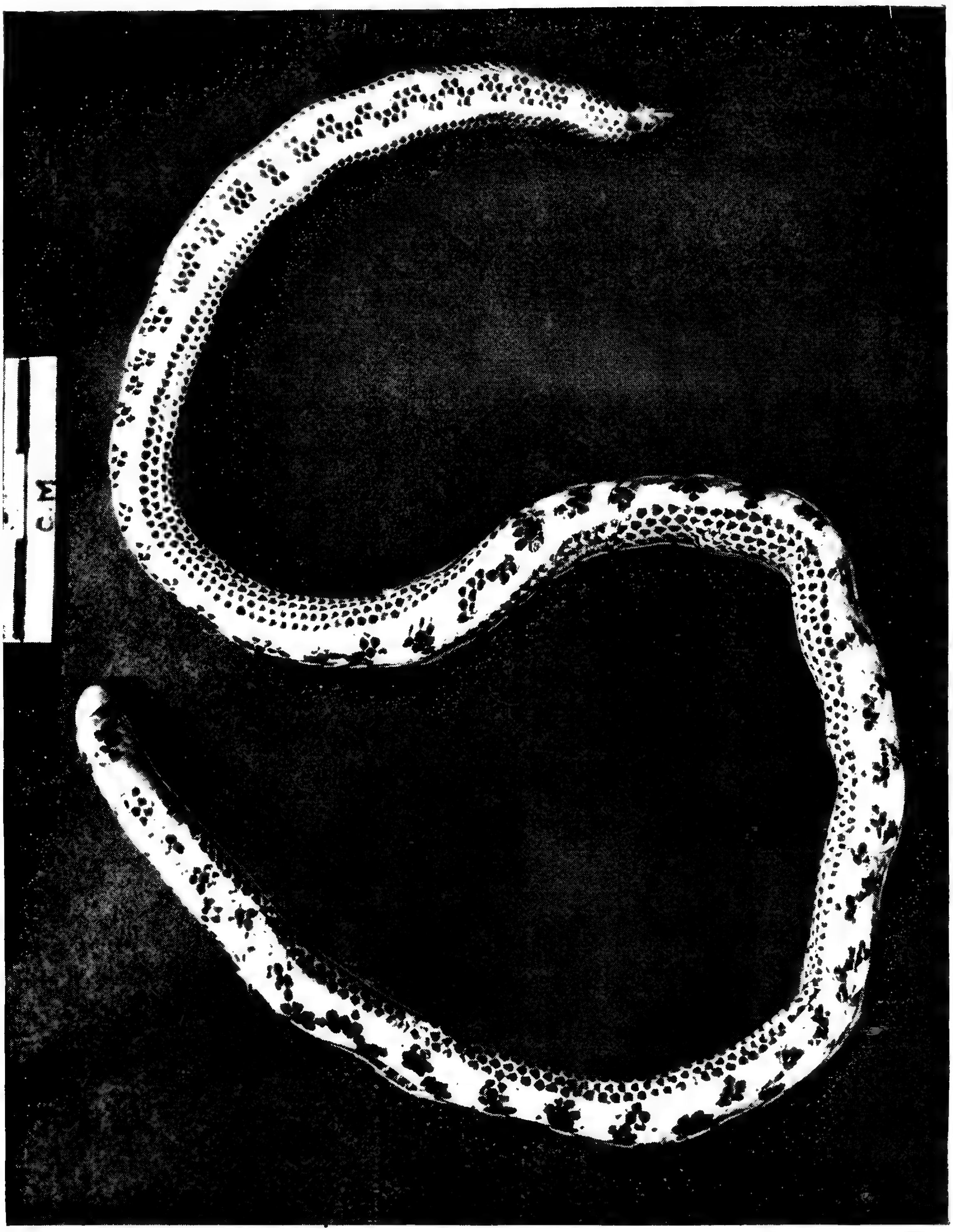
EXPLANATION OF PLATE I.

Photographs of *Rhinophis dorsimaculatus* sp. nov.

(A) Showing size of caudal shield, black dorsal blotches and lack of anterior enlargement of the body × $\frac{3}{4}$ natural size.

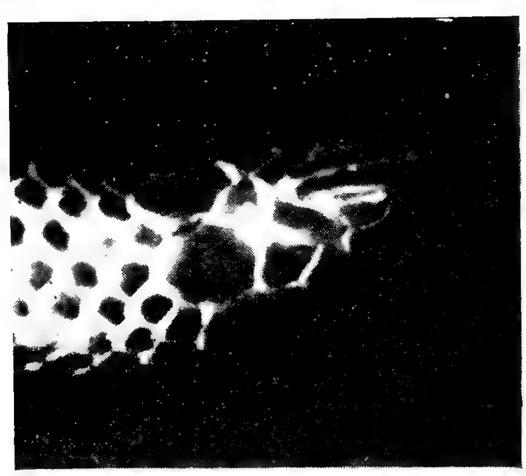
(B) Ventrilateral view of head × 7 $\frac{3}{10}$ natural size.

(C) Enlarged head of photograph (*a*) showing dorsal scalation × 7 natural size.



A

B



C

Rhinophis dorsimaculatus sp. nov.

For explanation see end of article.

THE GAME FISHES OF INDIA[1].

BY

SUNDER LAL HORA, D.SC., F.R.S.E., F.Z.S., F.R.A.S.B., F.N.I.,

Assistant Superintendent, Zoological Survey of India, Calcutta.

(*With* 3 *plates and* 2 *text-figures*).

(*Continued from page* 532 *of Vol.* xlii, No. 3).

XIV. THE MAHSEERS OR THE LARGE-SCALED BARBELS OF INDIA.

7. THE BLACK MAHSEER WITH NOTES ON OTHER COLOUR VARIETIES.

Mr. R. E. Parsons, F.R.E.S., Indian Police, Dibrugarh, Lakhimpur District, Assam, directed the attention of the Bombay Natural History Society to the lack of information about Black Mahseer in my series of articles on the Game Fishes of India and made the following interesting observations in his letter of May 5, 1941:—

'I have read with great interest Dr. Sunder Lal Hora's series, *The Game Fishes of India,* with particular reference to Mahseer. I have not, unfortunately, got the numbers of the *Journal* in which they were published before me at the moment, but one point has struck me, which I think is correct and that is that Dr. Hora makes no mention of a *black* Mahseer. I do not know whether these black fish are a distinct species of Mahseer or whether they are instances of melanism. They inhabit the same water, take the same bait and fight in exactly the same way as the ordinary Mahseer that one usually obtains in Assam rivers. They are also of the same shape, but the colour is definitely black with a little white about the belly scales. I have personally caught only two of these black Mahseer. The first I obtained on the 19th November 1934 on the Sisseri river in the Sadiya Frontier Tract, Assam. It weighed 16 lbs. and was a game fish, giving an excellent fight on a light 7 ft. 'Victor' rod. The other I caught at Ukiam on the Um Khri river in Kamrup District, also in Assam, on the 29th December 1937. This latter fish weighed 11¾ lbs. and had a little more white about the belly. These black fish are evidently very rare, although they are occasionally caught. Mr. F. Needham of Munkongselek, in the Sadiya Frontier Tract, has obtained several, the biggest being just over 20 lbs. I enclose photographs of the specimen I obtained on the Sisseri where it is photographed with the remainder of my catch for that day; the contrast in colour is very striking. It is noticeable that even the fins are black, as well as the tail. I do not think that it can possibly be that the black colour of these fish is due to the nature of the bed of the river they inhabit, for there are the ordinary type of Mahseer in the Um Khri and the four fish on the right of the enclosed photograph, including the black specimen, all came from the same pool in the Sisseri. The other three fish show the usual colouration. This pool was not very deep and had a sandy bottom at the lower end with small boulders at the top end. The river is in a wide valley at this point and was by no means in a dark gorge.

'There was no doubt that the two specimens I got were Mahseer and not some other species. The general shape and appearance were quite unmistakable. It was only the colour which was so completely different. It is, I suppose, quite possible that melanism is met with in fish as in other orders.'

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[1] Published with permission of the Director, Zoological Survey of India.

In a subsequent letter, dated 31st May 1941, Mr. Parsons referred to two more records of Black Mahseer from Assam and stated:

> 'On looking more closely through my records, I find that I have caught two other black Mahseer besides those mentioned in my previous letter. The two fish I did not mention previously were caught (1) on the Syon River, a tributary of the Brahmaputra on its right bank about 40 miles north of Pasighat in the Sadiya Frontier Tract. This fish weighed 18 lbs. and the name of the place I caught it was Pangin. (2) The other fish was caught at Rongdoi near the confluence of the Brahmaputra and the Lohit on 29th January 1937 and it weighed 10 lbs. Rongdoi is also in the Frontier Tract.'

Mr. Parsons' surmise about the identity of his Black Mahseer is correct and morphologically the black specimen photographed by him (Plate ii, fig. 2) is indistinguishable from the common Mahseer of Assam, *Barbus* (*Tor*) *putitora* (Hamilton). It may be pointed out that though melanism is not so common a phenomenon in fishes as albinism, several interesting cases of melanism in divers types of fishes are on record. Attention is directed below to some of these cases.[1]

In 1871, Günther (**6**) recorded a black specimen of *Platyglossus notopsis* Blkr., and observed:

> 'We have received from the Godeffroy Museum a specimen from Savay of a uniform black colour; however, the two ocelli on the dorsal fin are present, and it has also thirteen soft dorsal rays, so that it must be regarded as merely a variety.'

In 1875, Fatio (**4**) discussed melanism in *Phoxinus laevis* and concluded that though the nature of food is generally responsible for melanism, in the case of *P. laevis* presence of Helminth parasites encysted in the skin of the fish were probably the cause of the change in colouration. Knauthe (**13**) was of the opinion that melanism in fishes resulted not from the nature of the food taken by them, but through lack of food, *i.e.*, starvation. He had observed melanism in *Cyprinus carpio* var. *nudus* v. *alepidotus*, *Carassius carassius*, *Gobio fluviatilis*, *Leucaspius delineatus*, *Leuciscus phoxinus*, *Nemachilus barbatulus* and *Esox lucius*. In an important contribution on melanism in animals in general, Klunzinger (**11**, pp. 280, 281) dealt with some of the earlier records among fishes and considered the secretion of black pigment under the following headings: (*a*) inner constitutional peculiarities and (*b*) external factors, such as (i) influence of light, (ii) influence of temperature, (iii) influence of humidity (iv) influence of food and (v) influence of climate. Four years later, he (**12**) observed a large proportion of frogs and trout of certain ponds with a uniform black colour and ascribed this colour peculiarity to the acids produced by the humus soil. At the same time, he referred to the changes of colouration in the males of certain fishes during the breeding season. Annandale (**1**) described certain melanic specimens of *Barbus ticto*, but Hora, Misra and Malik (**8**, p. 267) found them to be males of *B. conchonius* and stated (p. 270) that during

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[1] Numerals in thick type within brackets refer to the serial number of the various publications listed in the bibliography at the end of the paper.

the breeding season males of several species of Carp-Minnows develop melanic colouration.

In 1935, Goff (**5**) recorded a case of melanism in *Lepisosteus osseus* and observed:

'During April 1933, while gigging gars in Lake Harris, Lake County, Florida, a melanistic specimen was picked up. It was the common long-nosed gar, *Lepisosteus osseus*. At first it was thought that it might be covered with some foreign substance but a vigorous washing and closer examination showed the coloring to be in the specimen itself. Since the writer had never seen a gar that approached this one in color a picture was taken of the specimen beside a normally colored individual. This picture brings out fairly well the degree of darkness in comparison with the normal.'

The observations recorded by Goff are similar to those made by Mr. Parsons regarding the Black Mahseer (*vide supra*, p. 803).

An interesting case of localized cutaneous melanosis occurring in lungfishes (*Lepidosiren*) of the New York Aquarium is recorded by Smith and Coates (**19**). They are of the opinion that 'Abnormal black pigmentation of the skin of fishes seems to depend on both genetic and post-embryonal factors.' Further, it is stated that 'Pathologic pigmentation of the skin caused by an increase in the number of melanophores occurs, for example, when certain parasitic larvae gain access to the skin and become encysted.' Attention is also directed to the fact that 'Experimental studies covering a wide biological field attribute pigmentation to disturbances involving the endocrine system or enzyme activity.'

So far as I am aware, the melanic pigmentation of Black Mahseer has not been properly investigated, but from the nature of the records available it seems that it may either be due to some genetic or pathological causes. As pointed out by Mr. Parsons, there is no difference in the ecological conditions of the Black and Ordinary Mahseer which could account for melanism among these giants of fresh waters.

The first reference to Black Mahseer I have been able to find is by Macdonald (**14**, p. 305) who regarded it as a distinct variety and characterized it as follows:—

'3. *The Black Mahseer*.—He is quite a different fish and of a stocky build. Head small and black, mouth small. Barbels and eyes black.

'This fish is marked by a jet black line two half scales above the lateral line, scales above having a tinge of gold on the scale tips running to jet black on the back. Below lateral line scales are lighter but dirty white, almost shot black to the scales on belly, which are dirty white with a black fringe. Fins black with grey at base. Best fish taken 19 pounds.'

The above description is not sufficient to distinguish the variety, but fortunately a good photograph of the black variety along with 4 ordinary Mahseer is published by Macdonald (plate i, fig. 2). A study of the figure shows that though the depth of the body is proportionately greater than that in the ordinary type, the length of the head is considerably greater than the depth of the body. On this character alone, it is possible to regard it as conspecific with the ordinary type—*Barbus* (*Tor*) *putitora* (Hamilton). The greater depth of the body may be due to its being a mature female.

In 1933, Macdonald (**15**) described once again the varieties of Mahseer in Burma and regarding the Black Mahseer stated (p. 107)

that it is common in all the rivers of Burma, where the banks are thickly wooded. Earlier, on p. 106, it is mentioned about the Black Mahseer that it 'is common both in India and Burma, where the banks of streams are overgrown with thick forest.' According to Macdonald, therefore, there is a correlation between melanism in Mahseer and the type of locality frequented by such specimens. There is no doubt that environment plays considerable part in determining the colouration of a fish, but how far melanism in Mahseer is due to the shade-factor in its habitat I am unable to say. (For further discussion on this point see below pp. 811-814).

Shebbeare (**18**) described a Dark Variety of Mahseer from the Eastern Himalayas and stated:

> 'The dark fish, or this specimen at any rate, was in shape far more like a Katli than a Mahseer. The fins were partly the yellow of the Mahseer and partly the slate colour of the Katli—the general colour of the fish was intermediate but the eye was golden, as in the Mahseer; only one spot on one iris was copper as in the Katli, but this may have been blood-shot. There were no tubercles on the upper lip.'

The Dark Mahseer of Shebbeare was a thick-lipped specimen with the length of head, as shown in the sketch, considerably shorter than the depth of the body. There seems hardly any doubt that Shebbeare was dealing with a partially melanic specimen of *Barbus (Tor) tor* (Hamilton).

From South India also there is a record of a Black Mahseer. Van Ingen (**10**), in his observations on Mahseer Fishing in Mysore, gives a figure of a Black Mahseer which is not unlike the ordinary Mahseer of the Mysore waters—*Barbus (Tor) khudree* Sykes (Hora, S. L. and Misra, K. S.—*Journ. Bombay Nat. Hist. Soc.*, vol. xl, pp. 24-28, 1938).

From the records of Black Mahseer referred to above, it is clear that it cannot be regarded as a distinct variety, since melanic specimens belonging to different species have been described or figured as Black Mahseer.

Though relying on the authoritative work of Day (**3**), different kinds of Mahseer have been treated as one species, *Barbus tor* (Hamilton), the anglers have long been familiar that there are more than one kind of Mahseer in Indian waters. But unfortunately in recognising varieties, anglers have been influenced by the colour of their specimens or by the nature of the lips. It has been pointed out in my articles on Mahseer (**9**) that these characters are not constant and, therefore, very little reliance can be placed on them for distinguishing species. In this connection, it may be recalled that Hamilton (**7**), who was the first person to make Mahseer known to science, recognised three species from the Himalayas, *Cyprinus putitora*, *C. tor* and *C. mosal.* Hamilton was familiar with the affinities of the three species and under *C. putitora* he observed:

> 'This and the two following species have, in many points, a strong resemblance, being very large fishes, affording an excellent wholesome nourishment, free from bones, although not quite so delicate as the *Rohita*. They are all

Fig. 1.—A Black Mahseer from Mysore.
(Reproduced from *Journ. Darjeeling Nat. Hist. Soc.*, vol. xii, facing page 30, 1937).

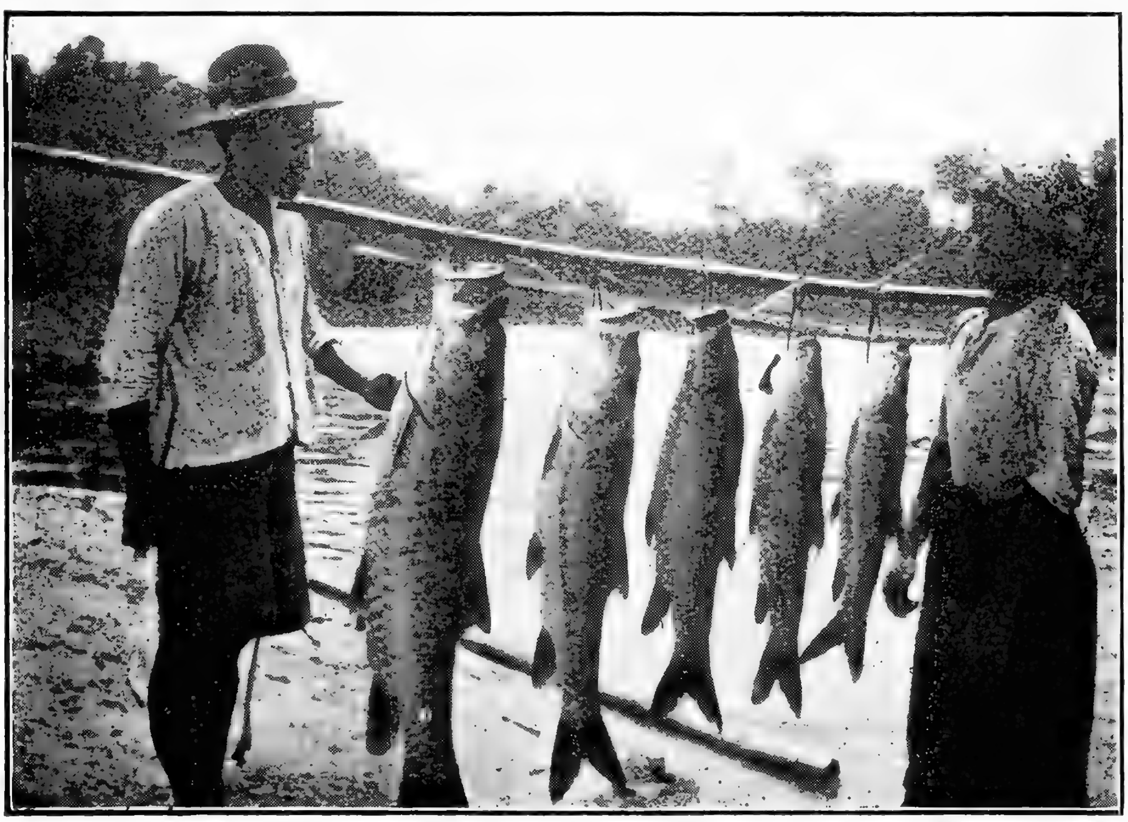
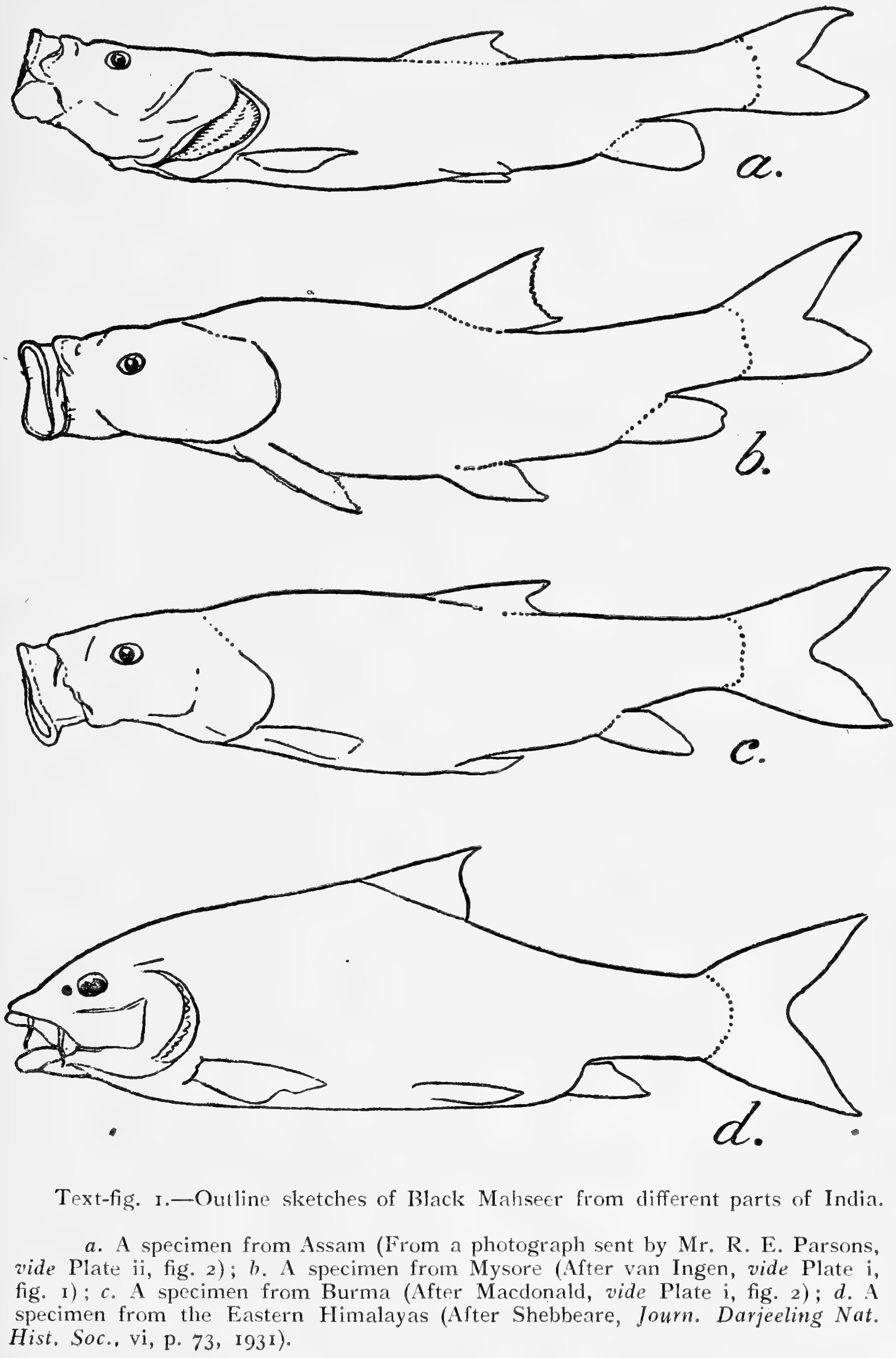


Fig. 2.—A Black Mahseer (15 lbs.) from Burma in the centre with four ordinary Mahseer (38, 21, 9 and 6 lbs. respectively). (Reproduced from *Journ. Bombay Nat. Hist. Soc.*, vol. xxxiii, facing page 304, 1929. This illustration has also been published in the *Journ. Darjeeling Nat. Hist. Soc.*, vol. vii, 1933).

also strong, well formed, handsome fishes, peculiarly distinguished by the enormous size of their scales, which, in large individuals, almost equals the hand, insomuch, that cards for gaming are sometimes made of them at Dakha. *Mahasaula* and *Tora*, variously altered or corrupted, or with various additions, may be considered as generic appellations among the natives for these fishes, all of which frequent large rivers.'



Text-fig. 1.—Outline sketches of Black Mahseer from different parts of India.

a. A specimen from Assam (From a photograph sent by Mr. R. E. Parsons, *vide* Plate ii, fig. 2); *b.* A specimen from Mysore (After van Ingen, *vide* Plate i, fig. 1); *c.* A specimen from Burma (After Macdonald, *vide* Plate i, fig. 2); *d.* A specimen from the Eastern Himalayas (After Shebbeare, *Journ. Darjeeling Nat. Hist. Soc.*, vi, p. 73, 1931).

Though in the 3rd edition of his *Rod in India,* Thomas (**20**, p. 27) bowed before the authority of Day and recognised *Barbus tor* as equivalent to Mahseer, he made it clear that:

'Further experience has confirmed me in the view advanced in 1873, that there are more Mahseers than have been named, and that if it were possible that as much accurate attention could be given to the Mahseer as has been devoted to the Salmonidae of Great Britain, of Europe, and of America, it would be found that the Mahseers of India would likewise grow in numbers.'

Thomas, chiefly dealing with South Indian Mahseer, was of the opinion 'that there are at least three distinct forms with difference of external structure, and many more with differences in colouring.'

This has been the feeling of all subsequent writers on angling in India, but no one dared to challenge the views of Day as regards the scientific nomenclature of this important group of fishes. In 1919, Annandale (**2**, p. 134) broke away from the orthodox view and while commenting on the systematic position of the Indian species assigned to *Barbus* Cuvier made the following remarks concerning Mahseer:

'Indeed, there is no group in which confusion is greater than that of the Mahseer so familiar to Indian sportsmen.

'I have not the material to attempt a revision of the Mahseer group, specimens of which are difficult to preserve in large series on account of their size, but two species have recently come to my notice which it seems justifiable to rescue from the oblivion of synonymy as they possess differential characters of a marked nature and likely to be constant. These species are *Barbus putitora* (Ham. Buch.) and *Barbus mussullah,* Sykes. That Hamilton's *mossul* and Jerdon's *hamiltonii* differ in some respects from the *forma typica* of *Barbus tor* the collection in the Indian Museum provides abundant evidence, while specimens from the upper Kistna seem to differ from any of these; but the question whether the differences should be considered specific or merely racial must be left to be answered with more extensive experience.'

In the preceding articles on the Large-scaled Barbels of India, I (**9**) have attempted to differentiate between the forms found in North India and shown that, besides the three species described by Hamilton, there is probably another species, *Barbus (Tor) progeneius* McClelland, in the rivers of Assam (*Jungha* of the Assamese). The Katli of the Nepalese or Bokar of the Assamese, *B.* (*Lissochilus*) *hexagonolepis* McClelland has also been described, but this fish is not a Mahseer in the true sense of the word, for its labial groove is interrupted in the middle and the lips never form flaps. I have thus recognised 5 species of Large-scaled Barbels from Northern India and Burma, but the specific identity of *progeneius* is rather doubtful. From these regions, Macdonald (**14**; **15**), Shaw and Shebbeare (**16**) and Shebbeare (**17**, **18**) have recognised several varieties of Mahseer and it may be worthwhile to comment here on their scientific position.

From his experience of fishing in the Myitkyina District, Northern Burma, Macdonald (**14**, p. 304) recognised six different varieties of Mahseer, though he noted that 'They all fit the description of Dr. Day's *Barbus tor* in the main points i.e. Barbels, "Fin" rays, and lateral line, etc.' His first variety is the Golden or Himalayan

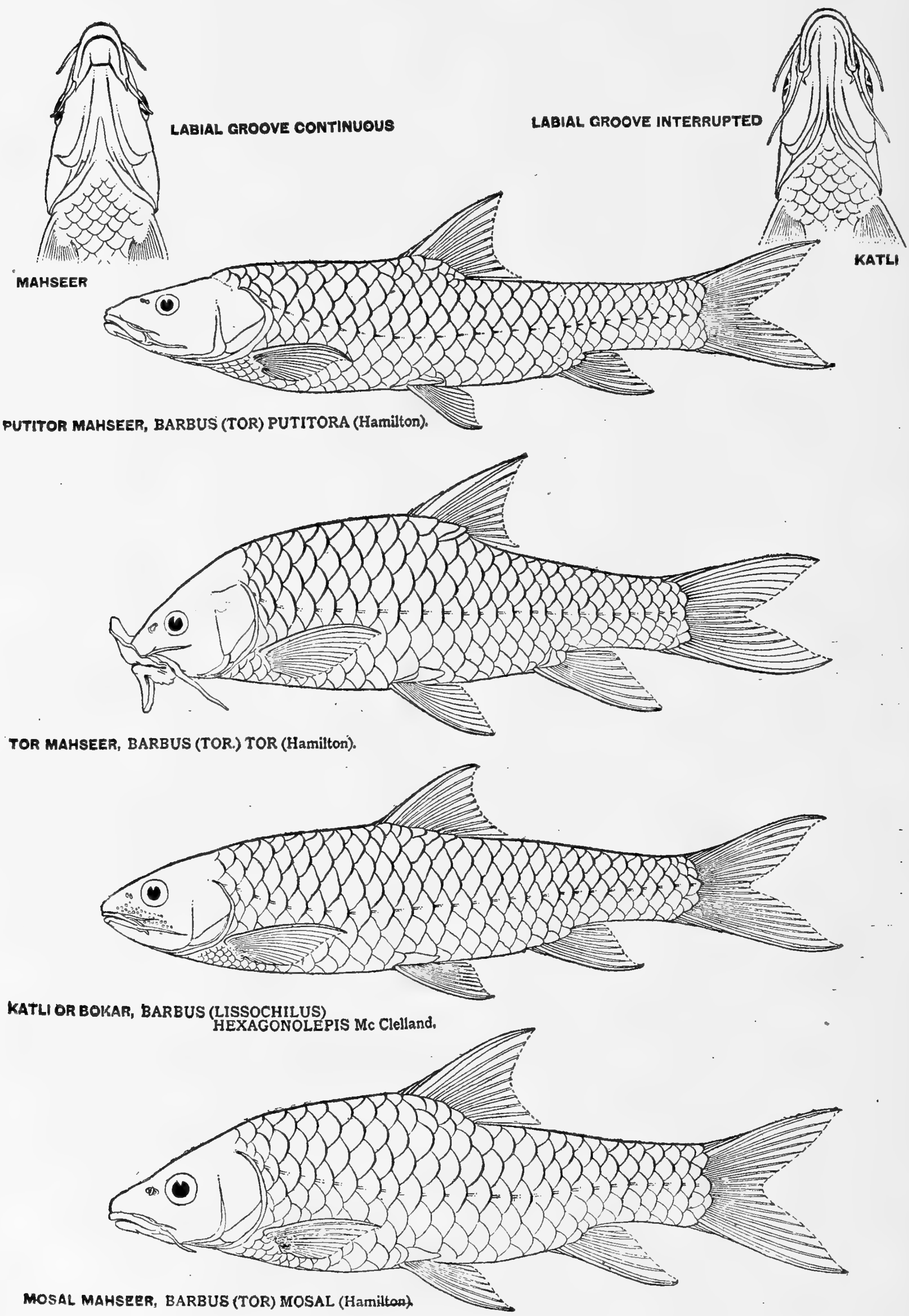
Mahseer with a decided black line down the side. His photographs show that this is *Barbus* (*Tor*) *putitora* (Hamilton). The Thick-lipped variety is described as 'Same colouring as Himalayan Mahseer differing only in the head. Chief features are the thick lips with the adipose extension which is well illustrated in Thomas' *Rod in India.*' It has been shown in my previous articles (**9**) that extensions of lips may occur in several species of *Barbus* of South-eastern Asia and Africa and though the true significance of these structures is not clear, they cannot be regarded as specific or racial characters. The Thick-lipped variety is also stated to be fairly common. Regarding the Black variety, it has been shown above (*vide supra*, p. 806) that it is only a convenient name for the melanic specimens of different species. His photographs of both the Thick-lipped and Black varieties show that they are referable to *Barbus* (*Tor*) *putitora* (Hamilton). Mr. Macdonald sent me another photograph of his Black variety from Burma and this proved to be *B.* (*Lissochilus*) *hexagonolepis*. It would thus appear that colouration served as the main character for differentiating varieties. The photograph of the Copper Mahseer shows that its head is almost equal to the depth of the body and on this character it is possible to assign it to *Barbus* (*Tor*) *mosal* (Hamilton). This species is more commonly met with in Burma. The Chocolate Mahseer, with thin lips and bright orange spots under lower jaw on chin, is probably *B.* (*Lissochilus*) *hexagonolepis* McClelland, while the specific identity of the Red Mahseer is difficult to ascertain as the author has not published a figure of the variety. Mr. Macdonald has very kindly sent me a photograph of this variety (Pl. ii, fig. 1) which shows that this is also referable to *B.* (*Lissochilus*) *hexagonolepis*.

In 1929, Shaw and Shebbeare distinguished four varieties of Mahseer from the Dooars, the Teesta and North West Assam. Their 'Commonest' type and the 'Greyhound' type are undoubtedly *B.* (*Tor*) *putitora*. The very thick-lipped and red-finned type, the so-called cock-fish, was at first regarded as a separate variety, but next year Shebbeare (**17**) considered it to be a 'breeding phase rather than a variety'. The fourth variety, from the description given, seems to be *B.* (*Tor*) *tor*. The specimen figured as 'Young of Commonest Type (?)' has a head shorter than the depth of the body and would thus seem to belong to Tor Mahseer. In 1931, Shebbeare (**18**) described a Dark variety which has been referred to above and seems to be a melanic specimen of *B.* (*Tor*) *tor*.

In commenting on Shebbeare's articles, Macdonald (**15**, p. 105) redescribed the varieties of Mahseer met with in Burma, and reiterated that the Thick-lipped variety is quite distinct and not a sex-phase of some other variety. According to him, the cock-fish of this type has 'a bump on the nose, and a more developed appearance about his whole form'. The distinction between the two sexes is given as follows:

> 'The male fish can easily be distinguished by the swelling or fleshy protuberance on the nose being extended farther and being more fully developed than in the female. The lips of the male fish are also much thicker and coarser than those in the female fish.'

I (9) have discussed fairly fully the causes which may be responsible for the enlargement of the lips in Mahseer, but observations are lacking to elucidate the exact significance of the hypertrophied lips. In view of the fact that individuals with hypertrophied lips



Text-fig. 2.—Mahseers or Large-scaled Barbels of Himalayan waters.

are to be found in practically all the species of Mahseer, this character cannot be regarded as a specific or racial feature.

The following key may help to distinguish specimens, over 9 inches in length, of the species of the Large-scaled Barbels of Northern India and Burma.

I. Labial groove interrupted in the middle; lips comparatively thin and never hypertrophied; cheeks covered with tubercles.

Barbus (*Lissochilus*) *hexagonolepis* McClelland.
The Katli of the Nepalese and Bokar of the Assamese. The Chocolate, Olive, Black or Red Mahseer of Burma.

II. Labial groove continuous; lips thick and well formed, sometimes produced into adipose flaps; cheeks smooth.[1]

A. Length of head considerably greater than depth of body.
Barbus (*Tor*) *putitora* (Hamilton).
The Golden or the Common Himalayan Mahseer including Greyhound and thick-lipped varieties.

B. Length of the head considerably shorter than or more or less equal to depth of body.

1. Length of head considerably shorter than depth of body.
Barbus (*Tor*) *tor* (Hamilton).
The Deep-bodied Mahseer.

2. Length of head more or less equal to depth of body.
Barbus (*Tor*) *mosal* (Hamilton).
The Copper Mahseer.

Addendum.

Copies of the typescript of the above article were sent to a number of well known anglers in India and their suggestions were solicited. Messrs. R. E. Parsons (Assam), A. Macdonald (United Provinces), C. Fairweather (Bengal) and Lt.-Col. R. W. Burton (Mysore) have very kindly sent their comments which throw further light on Black Mahseer and other races and varieties of this game fish.

Mr. Parsons notes that though Mr. R. W. Godfrey, Indian Police, Political Officer, Sadiya Frontier Tract, Assam, has caught several Black Mahseer, he has kept no records of them. 'The only one about which he was able to give me any details was a fish of about a pound in weight, caught on the Deopani river near Sadiya. This seems to indicate that the black colouration is inherent in this type of fish from a very early age.' Mr. Godfrey also mentioned to Mr. Parsons 'that while fishing in the Siang (Brahmaputra), some considerable distance into the hills north of Pasighat in the Frontier Tract, he noticed that the Bokar he killed were of a dark purple-plum colour instead of being the usual type. The Siang Valley in that locality is very shut in and even the water and stones in it looked black. It therefore seems that the dark colouration of the Bokar in the area referred to is due to conditions of environment and not to any question of melanism. However,

[1] In some of the true Mahseers of the Deccan and Southern India, tubercles are present on the cheeks. These forms will be dealt with in the subsequent articles of this series.

the Mahseer caught there were not different from the usual type.' Mr. Parsons on the basis of his records of Mahseer fishing finds that one black specimen turns up for about every 800 fish caught in Assam waters.

Mr. C. Fairweather in his communication to Mr. C. M. Inglis, Curator, Natural History Museum, Darjeeling, stated '"Black" Mahseer are quite common: I am inclined to agree that "wooded" banks have something to do with this *protective* colouring. . . I also caught Black Mahseer and Ordinary Mahseer from the same pool but the fish were travelling up at that time so the "same pool" means nothing.'

Mr. Fairweather also directs attention to another type of Mahseer—nicely streamlined, which is found in the Champamati, District Goalpara, and looks like a Katli with a sharper head but has the eyes and scales of a Mahseer. It is stated to be 'Very short and very deep in the belly . . . His tail and fins were bright red'. He suspects it to be a *cross-breed* and states 'There must be innumerable "crosses" between various types of Mahseer with infinite *modifications* of "lips". I cannot see the males of one type carefully selecting females of the same type for attention or rather "attendance". Therefore "noses" will get graded up or down.'

Hybridisation is a fairly common phenomenon among Carp or Cyprinid fishes and several instances have already been described. I (*Rec. Ind. Mus.*, vol. 36, pp. 307-310, 1934) have myself described cross-breed between two snow trouts—*Schizothorax labiatus* McClelland and *Oreinus sinuatus* var. *griffithii* McClelland and shown the occurrence of all gradations between the trilobed lower lip of the former and the papillated, flat lip of the latter. Mr. Fairweather's suggestion is very valuable and needs close scrutiny at the hands of those who have opportunities to handle large series of specimens of these game fishes. It is likely, however, that the nicely streamlined Mahseer of the Champamati may have been *Barbus* (*Tor*) *mosal* (Hamilton).

Col. Burton also states that Black Mahseer are found in the Cubbany River near Kartikolam below Manantoddy and he caught one black specimen of 5 lbs. (Plate ii, fig. 3) from the Bhavani also. He is also inclined to attribute variations in colouration to environmental factors. He states that:

'The pool in the Bhavani river where I caught the Black Mahseer was deep and shadowed by giant trees. The upper waters of the Cubbany river are in many places similarly dark and gloomy. So I feel sure that environment has much to do with the colouration of Black Mahseer.

'Many of the Mahseer taken by my party in the upper waters of the Kakki Ar in Travancore in 1933 were very deep in colour. That was a stream with much peaty looking water and running through thick forest.

'From the fact that during many years I never saw a Black Mahseer in the open sunlit rivers of Central India and Hyderabad—Godavery, Beema, Kistna, Tungabadra—it would seem that Mahseer of this colouration are not in those rivers, at any rate in the plains portions of them.'

Col. Burton has so far collected only one specimen of the Thick-lipped type in the Indravati on the Central Provinces border.

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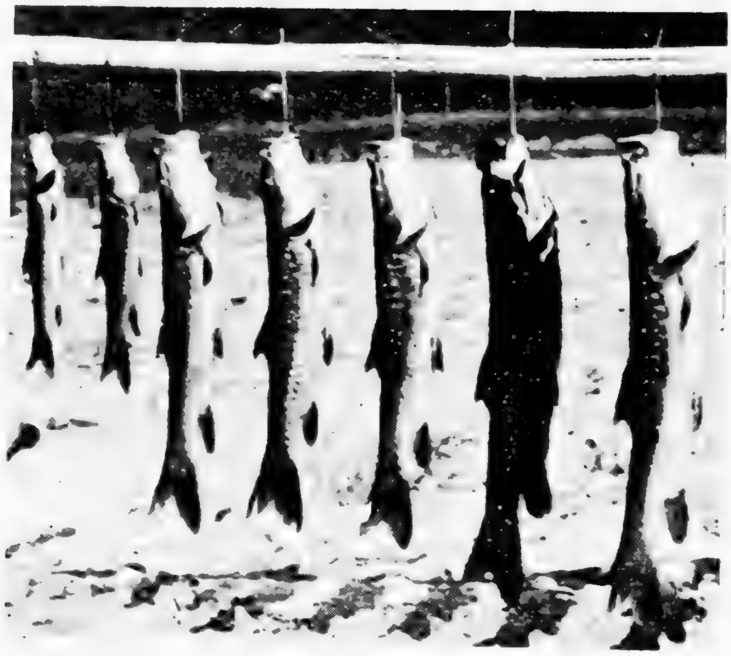

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Fig. 1.—A Red Mahseer from Burma. (Reproduced by courtesy of Mr. A. St. John Macdonald.)

Fig. 2.—A Black Mahseer (second from left, 16 lbs.) from Assam with six ordinary Mahseer. (Reproduced by courtesy of Mr. R. E. Parsons.)

Fig. 3.—A Black Mahseer (5 lbs., smallest specimen) from the Bhavani River with two ordinary Mahseer. (Reproduced by courtesy of Lt.-Col. R. W. Burton.)

Fig. 4.—A Black Mahseer from the Kumaon Hills. (Reproduced by courtesy of Mr. A. St. John Macdonald.)

Mr. Macdonald has also written to say that melanic specimens of the Ordinary Himalayan Mahseer, *Barbus* (*Tor*) *putitora* (Hamilton), are fairly common and may frequently be seen (one or at the most two) cruising about in shoals with the golden variety. He has found such specimens 'from ½ a pound to 37½ lbs., over as wide a range and as far as the Indus and the Jhelum and Mahl in the West Punjab; in the Ganges and Surju rivers in the U.P.; in the Girwa and Bhagmati in Nepal; and in Burma.' Mr. Macdonald has never collected a black specimen of the Putitor Mahseer with thick lips and this is certainly a matter of unusual interest and well worth further investigation.

Mr. Macdonald has observed that the black variety of Mahseer of the Naini Tal Lake 'can be seen in shoals by themselves, and aloof from the other fish, (*putitora*)'. It seems probable that in the lake there are two distinct species which do not mix with each other, but any further information on this point will be very interesting.

Regarding the stocky-type of Black Mahseer, Mr. Macdonald has sent the following further information:—

'I have only taken these fish in N. Burma in the Namti and Sahmaw Chaung. I have also seen them taken in the Mali H'Ka. In shape it resembles the Katli or Bokar far more than *putitora.* The Sahmaw Chaung is a small gin clear stream, no more than 10 yards across, and 15 miles over its total length. The Namti Chaung was a river of greater depth and size, but so far as my observations went here too, only this black variety of fish was caught. I never saw or caught a Chocolate Mahseer or Bokar in its common or more general colouring.'

A photograph of the stocky-type sent with the above description clearly showed that Mr. Macdonald had specimens of the Katli, *Barbus* (*Lissochilus*) *hexagonolepis* McClelland. As I have shown in my two articles on this species in the present series, this fish is liable to vary considerably in colouration. In fact, in Burma alone it has been called as 'Chocolate Mahseer' of the Myitkyina District, 'Olive Mahseer' of the Pegu District and 'Red Mahseer' of the Myitkyina and Tavoy Districts. The stocky-type Black Mahseer of Mr. Macdonald seems to correspond in colouration and habitat to Mr. Godfrey's Bokar of dark purple-plum colour from the Siang in Assam.

Regarding the development of thick lips, Mr. Macdonald has sent the following very interesting observations:—

'While fishing in the Ladaya in Kumaon, we used the casting net for catching small fish, small Mahseer provided the chief bait. These fish were from 4 to 10 inches in length, and in shoals of from 100 to 200 fish. We could get a dozen or more in the net at a time. In one place all would be of the thick-lipped variety, and in another the ordinary type. Is it possible that these fish all came from the same spawner, or through environment all developed these lips, or collected together for some special reason? Until I read your article I was inclined in the belief that they must be yearlings from the early spawn and had not separated. We caught some two hundred and fifty fish on this trip, and fully half were the thick-lipped variety. This is exceptional as the ratio is usually one in ten.'

As noted in my previous articles, I am unable to throw any definite light on the causation of the hypertrophy of the lips in the large-

scaled barbels of India and the neighbouring countries. Even some very young specimens possess this character in a marked degree, but we do not know what changes these structures undergo with growth and sex. These points are still open for investigation by enthusiastic anglers.

About his Red Mahseer, Mr. Macdonald has sent me the following further note:—

'These fish were in fairly large numbers at the same confluence in Burma in 1928. They were chiefly seen in quiet water of pools cruising about in shoals of 15 to 20 fish, and appeared to keep apart from the other varieties. They were in habit more like the Bokar, sucking vegetation from the surface and avoiding fast water so beloved of *putitora.*'

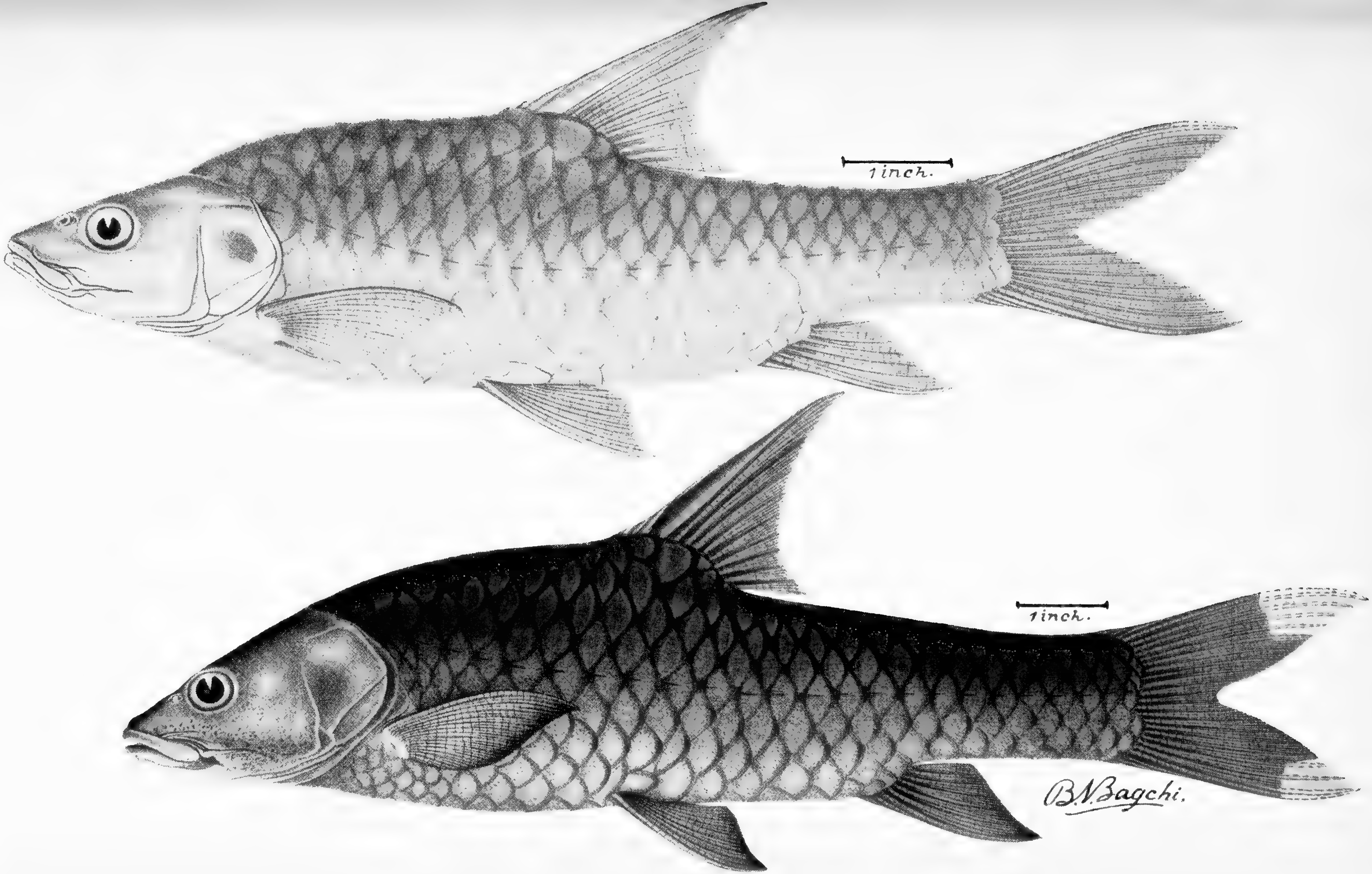
The photograph (Plate ii, fig. 1) that accompanied the above description showed that this variety is also referable to *B.* (*Lissochilus*) *hexagonolepis*. It may be noted that Mr. D. E. B. Manning sent specimens of the Red Mahseer of the Tavoy District which were found to be *B.* (*Lissochilus*) *hexagonolepis*.

To sum up, there appear to be four species of the Large-scaled Barbels in the Himalayan waters of which two, *Barbus* (*Tor*) *putitora* (Hamilton) and *B.* (*Tor*) *tor* (Hamilton) are found all over this region, while the remaining two, *B.* (*Tor*) *mosal* (Hamilton) and *B.* (*Lissochilus*) *hexagonolepis* (McClelland) are found towards the west only as far as Nepal but are more common in Burma. The last species is very variable in colour and is known to anglers under several names; its range has been extended to Nepal (Garwa and Bhaghmatti rivers) on the data supplied by Mr. Macdonald.

Through the courtesy of Mr. B. S. Bhimachar, Fisheries Officer, Department of Agriculture, Mysore, I have received two specimens of Mahseer from Bangalore which show normal and melanic colouration. Though I have not yet studied the races and varieties of Mahseer found in South Indian waters, I give here the drawings (Plate iii) of these specimens to show differences in colouration and at the same time their structural identity. The systematic position of these specimens will be discussed later. In sending these specimens Mr. Bhimachar observed that 'among the Mahseer at Bangalore, the local people distinguish two types—the ordinary type and a black variety'. It would thus appear that the melanic specimens are of frequent occurrence in those parts. In this connection reference may also be made to Col. Burton's observations given above (*vide supra*, p. 812).

Acknowledgments.

As will be seen from the text and descriptions of figures, in writing this article I have received much help from several persons interested in the study of Mahseer and it gives me great pleasure to extend my sincerest thanks to Messrs. R. E. Parsons, A. St. John Macdonald, C. E. S. Fairweather, S. H. Prater, C. M. Inglis, B. S. Bhimachar and Lt.-Col. R. W. Burton. I am indebted to the Darjeeling Natural History Society for the loan of blocks used for plate i, and to the *Bombay Natural History Society* for bearing the entire cost of the illustrations.



The two varieties of Mahseer from Bangalore, Mysore—"the ordinary type and a black variety".
(*Drawings were made from specimens sent by Mr. B. S. Bhimachar, Fisheries Officer, Mysore State*).

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SOME COMMON INDIAN HERBS WITH NOTES ON THEIR ANATOMICAL CHARACTERS.

BY

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(*With three plates*).

(*Continued from page* 601 *of Vol.* xlii, *No.* 3).

VIII.—EVOLVULUS ALSINOIDES Linn.

(CONVOLVULACEAE).

SYNONYMY AND SYSTEMATIC DESCRIPTION.

Evolvulus alsinoides Linn. Sp. Pl. ed. 2 (1762) p. 392; H.F.B.I., IV, 220; Cooke, Fl. Pres. Bomb., V. II, Pt. 2, 229; Gamble, Fl. Pres. Madras, Pt. V, 923; Duthie, Fl. upper Gangetic Plain, II, 104; Trim., Fl. Ceyl., III, 227; Watt, Dict. Econ. Prod., Ind. V. III, 305.

Syn.: *Evolvulus hirsutus* Lamk. Encyc. Méthod., V. III, 538; Dalz. and Gibs., Bomb. Fl., 162.

A perennial herb with a small woody root stock; annual branches numerous, prostrate, spreading, slender wiry, clothed with long hairs. Leaves alternate, 1/4-3/4 by 1/6-1/3 in., elliptic-oblong, strongly apiculate, densely clothed with appressed silky hairs; petioles very short or sometimes almost 0. Flowers light-blue, usually solitary, or sometimes two from a pair of lanceolate bracts on the peduncle; peduncles very long, axillary, filiform; pedicles filiform. Calyx densely silky; sepals 5, lanceolate, very acute. Corolla sub-rotate; limb 5-plaited. Stamens 5, included; anthers ovate; pollen grains spherical. Ovary 2-celled; ovules 4; styles 2, each cleft into 2 subclavate stigmas. Fruit a globose, thin, 4-valved capsule. Seeds usually 4. (Plates I & II.) Flowers practically throughout the year, but more abundant from July-November. Medicinal (Kirtikar, 6).

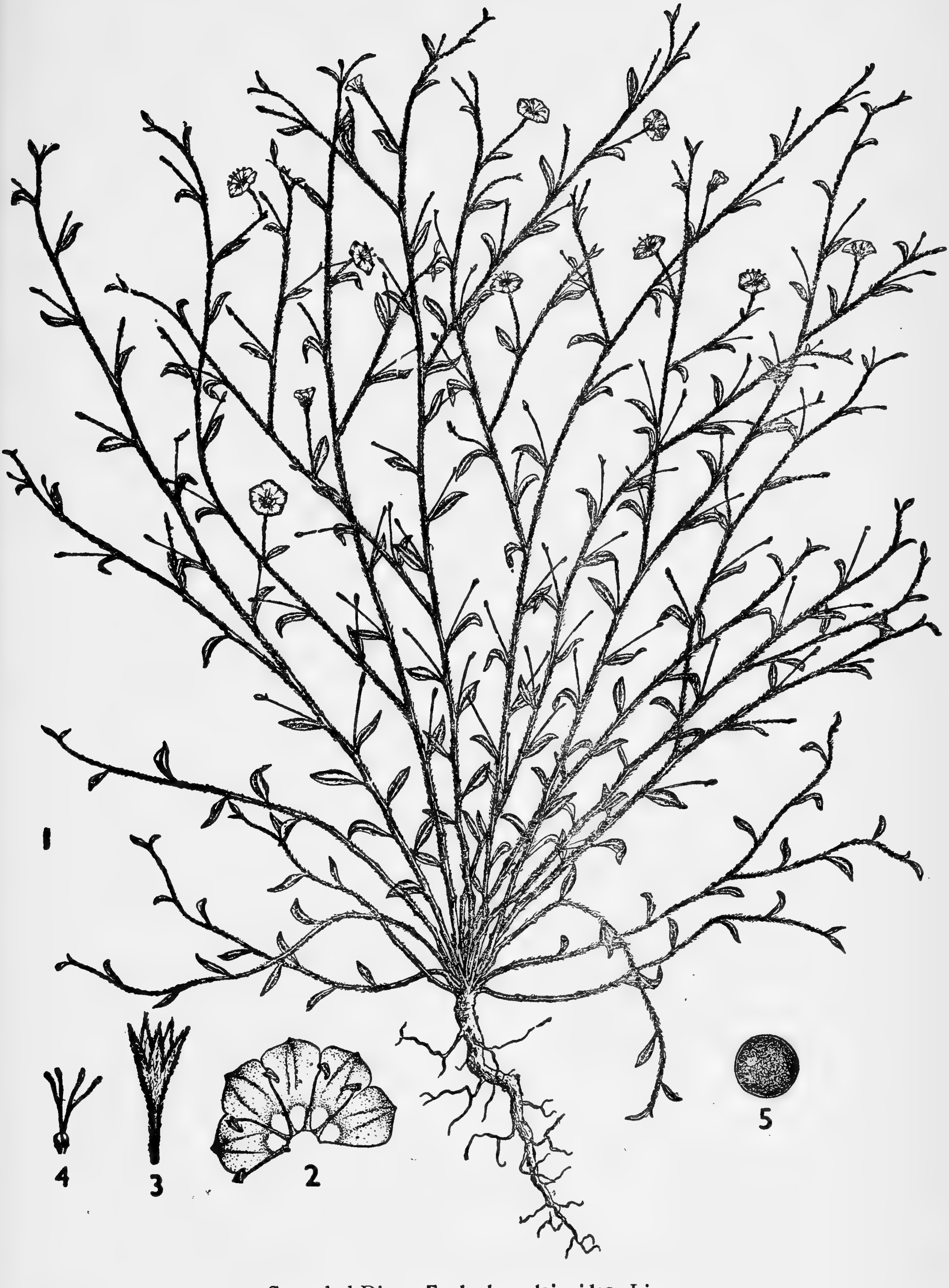
INDIAN NAMES.

Sankhpushpo (*Punjab*); Shankaveli (*Bombay*); Vishnukrandi (*Tamil*); Vistna--clandi (*Malayalam*); Vishnukranta (*Telugu*)

HABITAT.

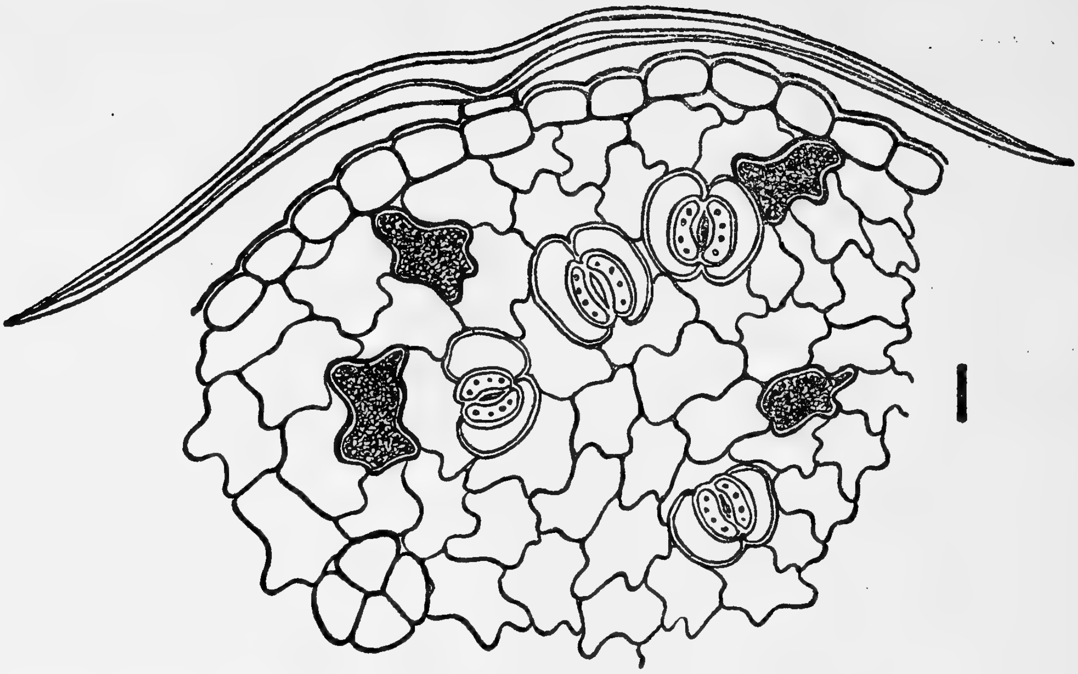
Throughout India and Ceylon, very common; rare in very damp regions (Hooker, 4); common everywhere in the Bombay Presidency in grassy places (Dalz. & Gibs., 2); very common in Madras

Sayeedud-Din.—**Evolvulus alsinoides** Linn.



Sayeedud-Din.—**Evolvulus alsinoides** Linn.

For explanation see end of article.



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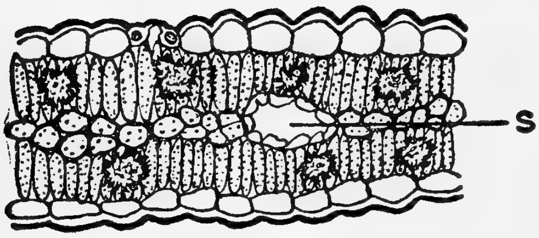

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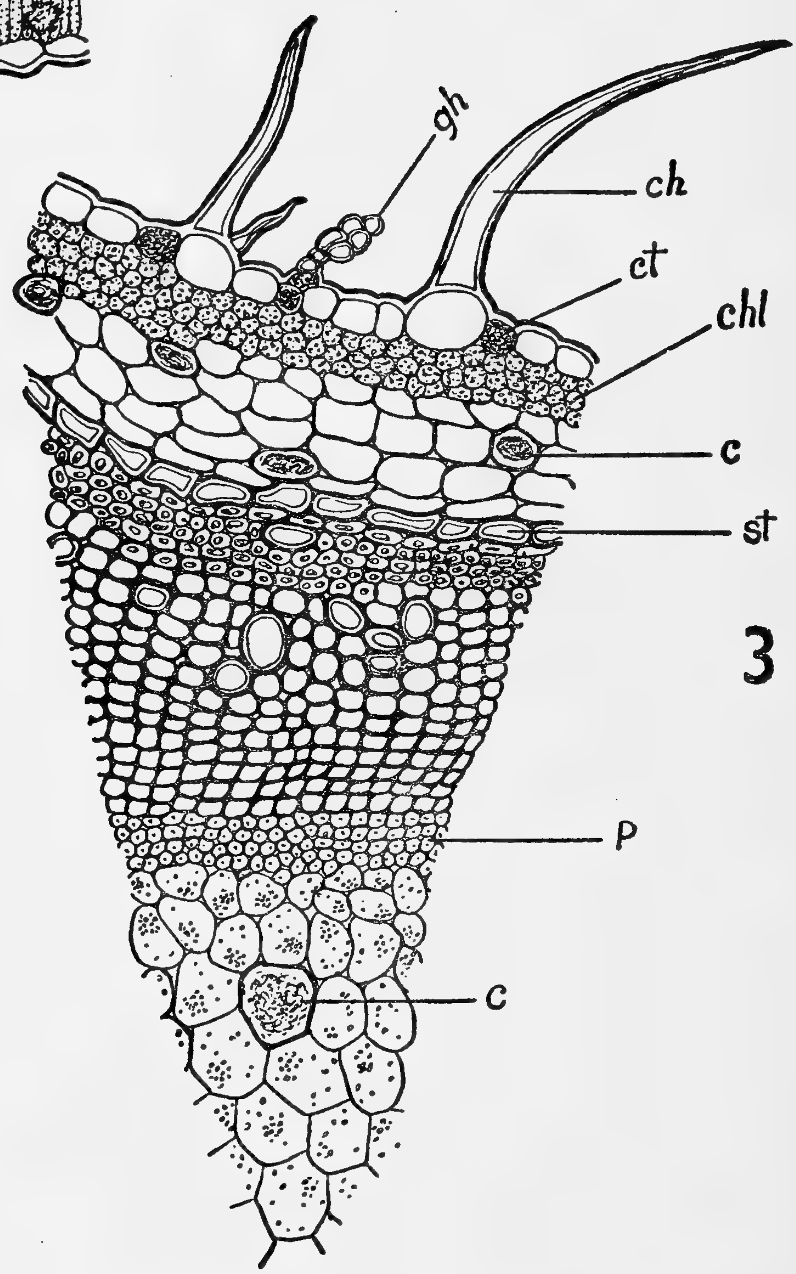

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Sayeedud-Din.—**Evolvulus alsinoides** Linn.

For explanation see end of article.

Presidency in grassy places except in the driest months (Mayuranathan, 7); commonly wild in Hyderabad on grassy lands and waste places (Sayeedud-Din, 10); very common in most parts of the Upper Gangetic Plain, especially on open sandy ground and by roadsides (Duthie, 3). Distrib.: Tropical and subtropical countries.

Anatomical Notes.

Structure of the leaf. (Plate III, Fig. 1.) The cuticle is thin and striated. The epidermal cells are enlarged, and their outer walls are arched convexly outwards. The stomata are developed on both surfaces where they are deeply sunk, and are accompanied by two subsidiary cells placed parallel to the pore. The leaf-structure is isobilateral.

Oxalate of lime occurs in varied shape in the leaf and stem. The clustered crystals occur only in the veins of the leaf. Secretory elements occur in the form of isolated cells containing whitish substance in the mesophyll, and in the cortex and pith. They do not, however, possess the surrounding specialised cells as, for example, those figured by Mullan (8) in the case of *Ipomaea pes-caprae* Sweet, or described by Sabnis (9) in the case of some species of the Convolvulaceae. Epidermal cells in the leaf and stem hold tanniniferous contents.

The clothing hairs consist of two cells. In the stem the long terminal cell is simple and unbranched, and inserted vertically on the short stalk-cell (Plate III, Fig. 2), whereas in the leaf the terminal cell has two nearly equal horizontally placed arms (Plate III, Fig. 1).

The glandular hairs consist of a short and unicellular stalk-cell seated on an epidermal cell. In the leaf the head is flat, and consists of four cells. In the stem the head is ellipsoidal and is divided by horizontal and vertical walls (Plate III, Fig. 2).

Structure of the axis. The cuticle is striated. The outer and inner epidermal walls are thickened and arched convexly outwards and inwards respectively. The lateral walls are straight. The primary cortex consists of chlorenchyma. The pericycle contains stone-cells in a broken ring. The vascular bundles are bicollateral. The vessels are numerous and arranged in rows, and the medullary rays are narrow and uniseriate. The intraxylary phloem is developed in the form of isolated groups of soft bast.

The above observations tally a great deal with those recorded by Solereder (11) in other species of *Evolvulus*.

Conclusions.

The following is a brief summary of the characteristic features revealed by the anatomical study of *Evolvulus alsinoides* Linn.

1. Stomata are surrounded by two subsidiary cells parallel to the pore of the guard-cells.

2. Oxalate of lime occurs in the form of ordinary solitary crystals in the stem, and in the form of clustered crystals in the veins of the leaf.

3. The hairy covering consists of two kinds of 2-celled hairs. The hairs on the stem possess a long straight terminal cell, whereas

those on the leaf have a 2-armed terminal cell, the arms lying horizontally.

4. The glandular hairs are of two types. In the stem the head of the hair is elongated and is divided by horizontal walls, but a few vertical walls are also seen. In the leaf the head is spherical and divided by vertical walls into four cells.

5. Isolated secretory cells with whitish contents occur in the mesophyll of the leaf, and the cortex and the pith of the stem. Those in the leaf are elongated horizontally. The epidermal cells in the leaf and stem hold tanniniferous contents.

6. The vascular bundles are bicollateral.

Acknowledgements.

I am thankful to Mr. Sri Ramloo for the photograph and the drawings which were prepared under my supervision, and to Mr. M. Moinuddin for kindly preparing the slides.

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Explanation of Plates.

Evolvulus alsinoides Linn.

Plate I.

Photograph of *Evolvulus alsinoides* Linn.

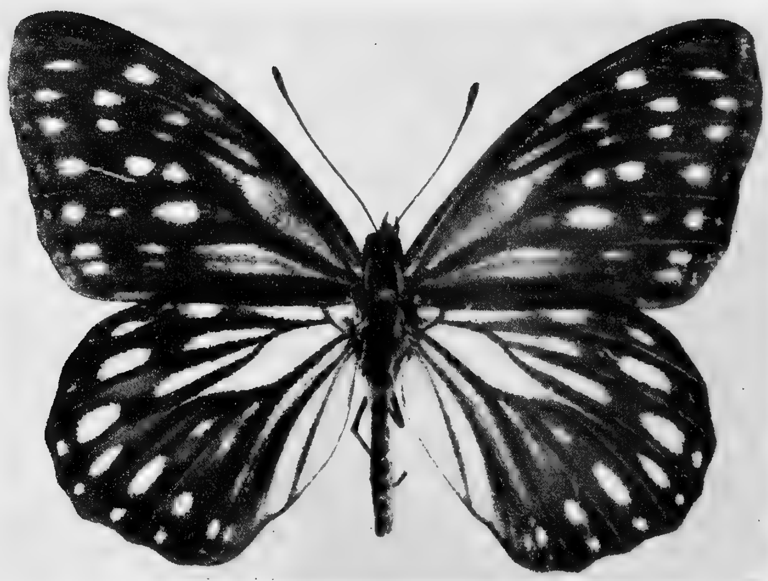
Plate II.

Fig. 1. Black and White drawing of *Evolvulus alsinoides* Linn. (Nat. size).
Fig. 2. Corolla opened out. (× 10).
Fig. 3. Silky calyx. (× 10).
Fig. 4. Pistil. (× 10).
Fig. 5. Pollen grain. (× 215).

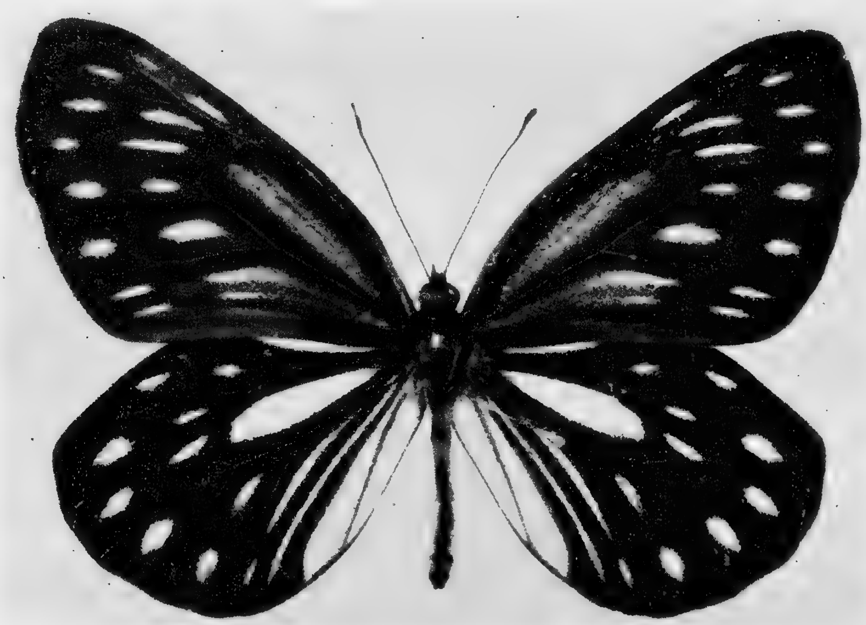
Plate III.

Fig. 1. Leaf-epidermis, showing a 2-armed hair, stomata, cells with tanniniferous contents, and a gland. (× 215).
Fig. 2. T. S. Leaf, showing, s, secretory cell. (× 215).
Fig. 3. T. S. Stem, showing, ch, ordinary clothing hair; gh, glandular hair; chl, chlorenchyma; ct, cells with tanniniferous contents; c, cells with whitish contents; st, stone cells; p, intraxylary phloem. (× 215).

DIAGORA NICEVILLEI
(*Moore*)
(Type) ♀
Indian Museum, Calcutta.



DIAGORA NICEVILLEI
(*Moore*)
(Neallotype) ♂
Godaveri, Nepal.
6000 feet. 16.5.37.
(Upperside).



APORIA AGATHON
(*Gray*) ♂
from Nepal.

DIAGORA NICEVILLEI (Moore).

BY

LT.-COL. F. M. BAILEY.

(*With a plate*).

This butterfly was first described by de Nicéville (1883, Journ. As. Soc. Beng., 52, pt. II, p. 65, Pl. I, Fig. 2) as the ♀ of *Hestina zella* (Butler). De Nicéville stated that the insect was taken on the forest-clad road between Chamba and Kujiah on 22nd May 1879.

Moore in 1893 (Lep. Ind. III, p. 37, Pl. 202, Figs. 2 & 2*a*) reproduced de Nicéville's figure and described the insect as a ♂ under the name of *nicévillei*, quoting de Nicéville's statement as to locality and date. Moore probably saw the specimen as he figures the underside (Fig. 2*A*.) which was not shown by de Nicéville. Moore said that only this single example was known to him.

The specimen in the Calcutta Museum bears a label with the same data as given by de Nicéville and is certainly the insect figured by Moore and must be the type of *nicévillei*. It is apparently a ♀ as stated originally by de Nicéville who was qualified to know. Authorities in the British Museum believe the figure to represent a ♀; but on the other hand, the authorities in Calcutta declare the insect to be a ♂.

On the outskirts of the Nepal Valley near Katmandu, I obtained specimens of a *Diagora* which is described below. De Nicéville's single type specimen was presumably an outlier in its extreme western range; but it is curious that this butterfly should never have turned up in the six hundred and odd miles between de Nicéville's locality and the area where I found it not uncommon. In this stretch of 600 miles lies Simla which has been pretty thoroughly searched for butterflies.

Another curious fact is that de Nicéville's single specimen should have been a female. I obtained over 20 males and no females. The female is probably a skulker and seldom seen, like many similar butterflies.

In view of the above facts it is possible that the Nepal butterfly may belong to a separate sub-species. It is to be hoped that someone will eventually find either the ♂ of de Nicéville's species in Chamba or the ♀ of the insect here described in Nepal.

I first took a single specimen a few miles N.-W. of Katmandu at 4,500 feet on 11-5-35.

About 20 more specimens of this butterfly were taken in the middle of May 1937 in the hills S.-E. of the Nepal Valley at 5,000 ft.

This insect is an excellent mimic of *Aporia agathon* which flies with it, but *Diagora* seems to be more plentiful at slightly higher altitudes. In fact, *A. agathon*, in the locality where *D. nicévillei*

was mostly found, does not occur much above 4,500 ft. *D. nicévillei* is partial to excreta and less often sucks the moisture from damp sand.

So good is this mimic that I was at first completely deceived. I was casually watching a group of *A. agathon* at damp sand when I suddenly noticed that one of them had a yellow proboscis. It did not take me long to capture it and realise that I had a Nymphalid and not a Pierid. At first I thought that I had a new species of *Diagora*, but in view of the fact that I did not obtain a female, and that the male of *Diagora nicévillei* has never been seen or described, it seems probable that the insect here described is the male of *D. nicévillei*. The above is written on this assumption.

Through the courtesy of Dr. Baini Prashad, Superintendent of the Indian Museum, to whom I am indebted for information about the Calcutta ♀ holotype, I am able to figure the upperside of that insect. I also show a photo of the upperside of a Nepal ♂ specimen as well as of *Aporia agathon* from the same locality which it so closely mimics. I am also much indebted to Mr. G. Talbot of the British Museum, for his help generally and especially for looking up the previous data regarding this butterfly.

Description.

Upperside: As compared with the ♀ type in Calcutta, the light areas are much reduced, but post-discal spots conspicuous, somewhat elongate, and with well defined rounded edges. Forewing post-discal spots in areas two and three not produced; Cell much darkened. Hind wing, post-discal stripes in areas 5 and 6 shorter and narrower than in the female.

Underside: The whole with a curious greasy appearance. Forewing cell stripe narrower than in the ♀ forming at the end of the cell a somewhat oval patch which tends to become separated from the proximal stripe; other markings as on the upper side, but somewhat larger especially the patch below vein 2 which is as large as in the female. Hindwing with light markings tinged with yellow excepting the cell stripe; inner stripes yellow as in the female; no prominent stripe in area 1C; post-discal spots in 2 and 3 minute; stripes in 4 to 6 short, those in 5 and 6 shorter than the stripe in 4 and much shorter than on the upper side; basal costal yellow stripe much shorter than in the female. The tongue is yellow; head, antenna, palpus, body and eyes as in allied species.

Expanse: 80 mm.; length of forewing 38 mm.

Hab.: Nepal, Godaveri Valley, 6,000 ft. 10th to 16th May, 1937. The neallotype and 5 paratypes have been deposited in the British Museum.

THE FOOD AND HABITS OF THE HOUSE-SPIDER (*HETEROPODA VENATORIA*, LINN.)

BY

G. C. BHATTACHARYA,

Bose Research Institute, Calcutta.

(*With two plates*).

All spiders are carnivorous and generally live on the more helpless invertebrates. But instances of their preying upon vertebrates also are not wanting. Accounts of the capture of fish, rats, snakes, frogs, lizards, etc., by some species of spiders have been recorded (**1-9**), but an instance of a spider preying upon a bat is unknown to me. Some months ago, I came across such an instance.

One evening, early in May, 1940, while observing the preying habits of a species of gregarious spider, *M. fultana,* (**10**) in the village of Kristapur, near the salt lakes of Calcutta, my attention was drawn by a cow-boy who cried out that a big spider was struggling with a peculiar creature in an adjacent cow-shed. Entering the shed I came upon an astonishing sight—a tiny bat (*Pipistrellus* sp.), caught as in a trap between two bamboo-strips of a matted wall, was struggling hard to free itself from the grip of the powerful mandibles of a big house-spider, *Heteropoda venatoria* (**11**), clinging to its neck with all its might (Plate II, Fig. 1). The bat screamed at intervals and gasped. As it was getting dark inside the shed a torch was focussed on the spot. The bat squeaked as the light fell upon it, and suddenly came out of the trap vigorously flapping one of its wings. The spider tried its utmost to maintain its original hold. The bat dragged itself out with the spider on its back and crawled a short distance to a smoother part of the wall with the peculiar gait of its own. It was tired and could not move far. It gasped hard and its voice was weak. It remained stationary for about 15 to 20 minutes, when all at once it began to flap its right wing and finally stretched it out to the fullest extent. After a minute or two the stretched wing began to fold itself back like an organ in atonic condition. In order to capture them *in situ* I very cautiously covered them with a crystallizing dish. A piece of plain glass was then slowly pushed under the dish so that both of them, the aggressor and the victim, were transferred on to the flat glass. Notwithstanding the slight disturbance caused by this process the spider did not release its grip but clung to its prey more firmly than ever. While carrying the captives to my laboratory the spider released its victim and took its stand on the vertical wall of the glass dish. For the night they were kept in a suitable place. Next

morning the spider was found with its legs outspread resting upside down at the top of the inverted dish. Its victim with its wings folded lay slightly inclined on its right side. It was taken out and found to be stone dead, *rigor mortis* having started long before. Evidently it remained untouched by the spider during the whole of the night because no wounds or scratches, other than the first, were traceable.

This strange incident led me to investigate the habits of these spiders, some of which are highly interesting and peculiar.

Barring a few species, spiders are not social creatures. Besides most of them are cannibalistic. Fights often occur when two happen to meet. *H. venatoria* displays this habit. If by chance one happens to come within close range of another of its species, both at first, try to avoid an encounter by running away, or by taking cover, but failing this they fight.

I had an opportunity of witnessing such a fight. The encounter took place on the wall of a room. Two big spiders, faced each other at a distance of not more than ten to twelve inches (Plate I, fig. 1). Both were females each carrying its egg-case under its breast. All quiet on the sooty wall,—a lull before the storm! Suddenly one of the antagonists, raising the front pair of legs high up in the air, rushed at its opponent, which, at first, showed signs of retreating, then stood its ground, meeting the onslaught with its two front legs raised. They stood at the 'on guard' for a while, then the aggressor fell upon its enemy with surprising agility (Plate I, fig. 2). They wrestled for two or three seconds only and then separated; the breathing space was short—an interval of two or three minutes—and the spiders joined combat for the second time. Throughout the grim struggle they kept a firm hold on their great egg-cases with the help of the pedipalpi. In the fury of the fight they suddenly lost their balance and fell into an enamelled tub at the foot of the wall. The fall in no way perturbed the fighters and the struggle continued with the same intensity. One of the combatants lost a leg, but did not evince the slightest sign of submission. Now they disengaged themselves a second time, there was an interval of a few minutes and the third round commenced. The spider with the lost limb showed signs of weakening and presently lay still. The victor turned it over till it lay flat on its back, then bit into its body maintaining its hold for a long time. The legs of the prostrate spider moved spasmodically, expanding and retracting. The egg-case was still held to its breast. This, the victor now removed, and holding it with one of its legs made off with its booty (Plate I, fig. 3). But the steep walls of the tub compelled it to remain a captive. I permitted it to enjoy its victory for a while.

At nightfall these spiders come out of hiding in search of prey and lie stationary in some suitable place with legs outspread. Innocent crickets (*Gryllus domesticus*), cockroaches are also night-roamers. At night they too come out of their crevices and move about in search of food and frequently fall victims to the spider lying still in ambush. Careless in their movements they come within easy reach of the spider which pounces upon the unwary

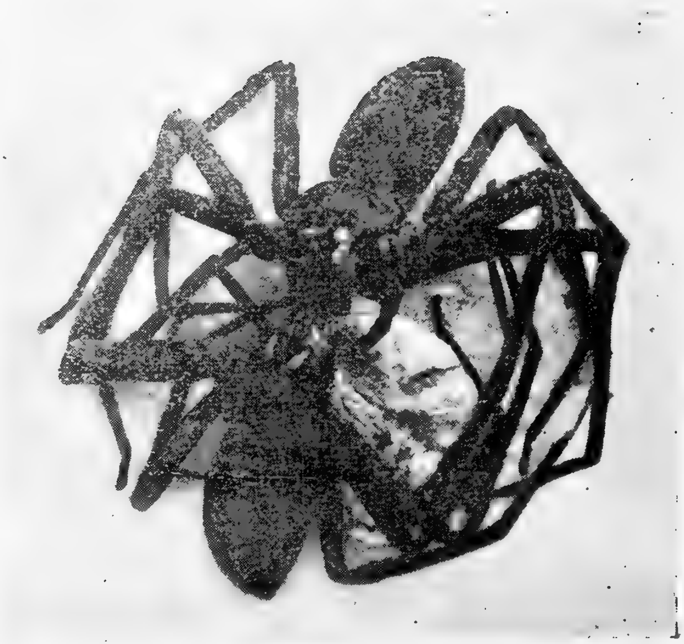


Fig. 2.—They come to grips.

Fig. 1.—The spiders faced each other, holding their egg-sacs securely.

Fig. 3.—The victor kills her opponent and carries off her egg-sac.

HOUSE SPIDERS (*Heteropoda venatoria*) IN COMBAT

VICTIMS OF THE HOUSE SPIDER (*heteropoda venatoria*).

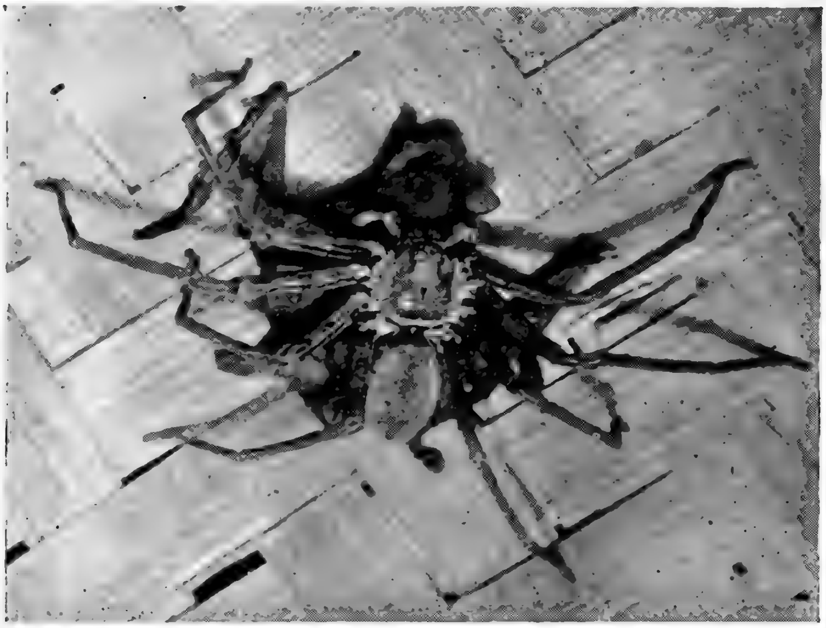


Fig. 1.—An unusual victim: House Spider gripping a pipistrelle bat in its mandibles.

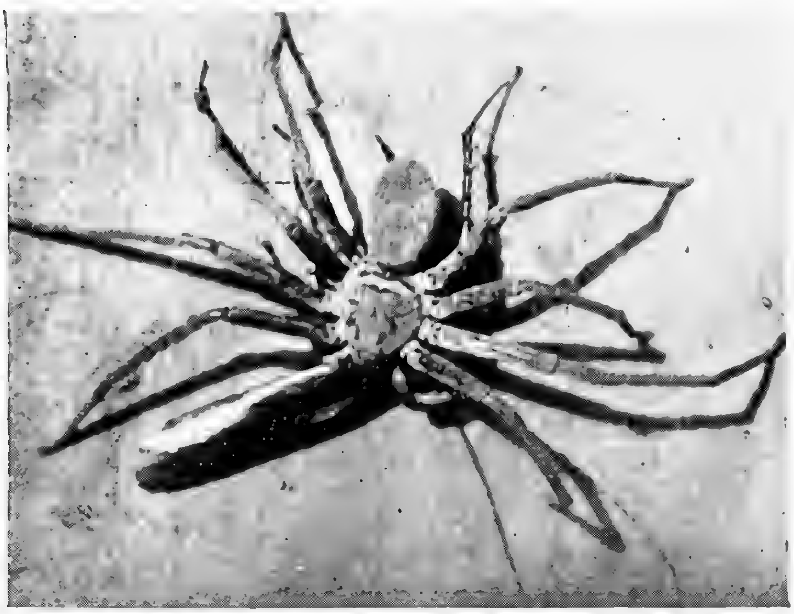


Fig. 2.—A useful service: These spiders help in ridding the house of cockroaches.

Fig. 3.—House Spider attacking a scorpion.

victim with lightning speed. Over-powered by its powerful bite and its poison a cricket dies almost instantaneously, but the cockroaches resist for some time. The spider carries the struggling cockroach from place to place until the poison takes effect and the insect's struggles cease, when it begins to chew the body to a ball-like mass sucking at the same time the juice out of it (Plate II, fig. 2). Their ways with house-flies are quite different and extremely interesting. This I had an occasion to observe while rearing and feeding them with flies. Flies were released into the rearing chamber one by one and the spider took them one by one in its jaws—a fly thus held cannot escape when the jaws open to receive the next victim. I have seen a spider take and keep in its jaws from ten to fifteen flies at a time. When it can hold no more, it starts to chew them *en masse*. In half an hour or so the juice is sucked to the last drop and the dried mass is ejected.

Once I came across a house-spider, *H. venatoria,* on the wall of a house with a young scorpion in its jaws. I tried in vain to capture the spider, but during the chase it dropped the scorpion. It was dead. The scorpion was identified as *Isometrus maculatus* (De Geer) and measured about one and three-fourths of an inch in length. Presumably it was preyed upon in the early hours of the morning. Scorpions are formidable, venomous creatures and it is astonishing that such a creature should be overpowered by a spider. In order to observe how this is accomplished I put a big spider, *H. venatoria,* in a spacious, flat, enamelled dish with high vertical walls. Here it was kept for some days after which a scorpion about two inches in length was let into the dish. The spider did not move at all. The scorpion remained stationary in the centre of the dish for a few minutes and then began to crawl about. Then it stopped and lay still at a point farthest from the spider. Nothing happened for two hours. Then the scorpion moved slowly along the angle of the dish till it came within reach of the spider; immediately the latter sprang upon the scorpion's back and firmly gripped the anterior portion of its body with its sharp fangs. The scorpion tried its utmost to sting its opponent reverting its tail over the spider's back, but it failed to drive its sting home perhaps because of the hard chitinous shell of the carapace. Unable to sting, the scorpion seized the legs of the spider in its pincers but could not keep its hold for a long time. It then tried hard to free itself from the grip of the spider by contortions of its body. The manœuvre did not succeed. The spider, seemingly yielding to the movements of the scorpion kept its grip on the victim as rigidly as ever. As the struggle continued the scorpion grew visibly weaker until it ceased to move at all and lay with its tail stretched flat on the surface of the dish. It was to all appearance dead. A few minutes elapsed. The spider now slowly moved its abdomen sideways and finally sat astride the scorpion's back. This seemed to bring the scorpion back to life. It suddenly swung its tail upwards and, bending it in an arch, tried over and over again, but without success, to sting the spider (Plate II, fig. 3). The spider avoided the thrusts shifting its abdomen with peculiar alertness. This was the scorpion's dying effort, in a while it collapsed and moved no more. The struggle had lasted for about an hour.

At about 8 o'clock, on a mid-August night in the year 1940, I was sitting inside a thatched cottage near Barrackpore, when a peculiar sight attracted my attention. I saw a big house-spider, *H. venatoria*, with its distended abdomen moving around a spot on the vertical matted wall of the room. I kept a watchful eye on it. The spider displayed a peculiar movement of its abdomen. Evidently it was not spinning a web as these spiders are not known to spin for shelter. So I waited to see what it was about. A few minutes later, I was surprised to see a round cup-shaped thing, about three-fourths of an inch in diameter gradually emerging. Was it making its sac for the deposition of its eggs? Never before had I an opportunity of observing *H. venatoria* making its egg-sac. It took half an hour to complete the lower half of the sac. With the lateral movements of its abdomen there issued fine threads of silk, which adhering together in layers, gradually took the form of a cup-shaped structure. The complete sac is composed of several layers of finely woven silk which give it great strength. Having completed the under half of the sac, the spider rested a while. Then lowering its abdomen it began to extrude its yellowish globular eggs in rapid succession into the cup-shaped capsule. The extruded eggs are covered with a thin film of adhesive fluid which hardens immediately on contact with the air, and are laid on the inner surface of the capsule in a layer. In quick succession eggs were deposited layer upon layer. In half an hour's time a goodly number had accumulated in a pile on the floor of the capsule. Laying continued at intervals till the capsule was full. When the egg-laying was over the spider paused for a while and then started spinning the cover for the capsule. The complete egg-sac looked like a double-convex lens, about an inch in diameter. The spider held the sac firmly against its sternum with the help of the pedipalpi which work like a pair of fasteners or holdfasts. Then it slowly walked some distance where it rested for a long time. These spiders carry their egg-cases for ten to fifteen days; when the young emerge from the sac and hang suspended by means of fine silk threads in clusters. The empty case is then discarded by the mother spider who takes no more interest in her brood. Remaining suspended in this way for two or three days the young spiders gradually disperse and begin to take up their independent existence.

The young spiders possess a sort of aeronautic habit which they utilize for dispersal to distant places. They climb to some height and, turning their heads to the breeze, raise the abdomen up in the air and extrude from it, fine threads of silk. When the thread is sufficiently long it catches the wind and exerts a pull on the spider. The young spider then releases its grip and is carried by the breeze. One might think that the process of climbing, lifting the abdomen and spinning the thread preliminary to the aerial flight takes some time, but far from it, these actions are often all but simultaneous and take little time. A tiny spider may in an instant run up a small twig and take straight to the air. Such an aerial journey may be short, or may cover miles. Thus carried through the air the spider establishes itself in a new territory.

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MESOPOTAMIAN DESERT LEPIDOPTERA[1]

BY

E. P. Wiltshire, F.R.E.S.

The Desert.

The desert with which this article deals covers a wide area; yet it cannot be clearly separated from the Syrian and Arabian deserts by any line of demarcation, and indeed also merges, though less imperceptibly, into the mountainous desert regions of Southern Iran. The localities at which the insects in the list were taken are in Syria, Iraq and Iran, though mostly in the second, but faunistically the area concerned can be regarded as one and the same and may suitably be termed 'Mesopotamia', a name now devoid of political connotation. The area's homogeneity does, however, allow of certain minor climatic differences, between the northerly and southernmost localities. For instance, the average humidity on the desert shores of the Persian Gulf is between 70% and 80%, that at Bagdad 56%, and that at Mosul well below 50%; and the average rainfall at Bagdad is 9 inches (230 mm.), and at Bushire 12 inches (300 mm.). This rain only falls in the winter.

The Mesopotamian desert is geologically of two kinds: the stony upland, and the alluvial plain. The former lies northward of the latter, but encircles it like a horse-shoe. To the north-east of the alluvial plain are the foot-hills and ridges of the Zagros range; to the south-west of it, the low plateau of scorched steppe whose northern part is the Syrian, whose southern, the Arabian, desert. A line drawn from Ramadi to Balad, about fifty miles north of Bagdad, approximately marks the northern limit of the alluvial plain. This plain is geologically very recent. Until, and probably during most of the Pleistocene period, the waters of the Persian Gulf covered it. Then the swiftly-advancing delta of the Karun and Kerkheh turned the sea-arm north of these two rivers into a vast lagoon, which gradually silted up with the slower advance of the Euphrates and Tigris delta, and passed, after a transitional marsh stage, into its present desert condition, only relieved by the more or less extensive irrigation systems of antiquity and today. This alluvial desert is less rich in life than the upland desert for reasons given below; so that, even after Central

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[1] This article is an abbreviated version of an article already announced as under preparation with the title 'The Saharan and other affinities of the Mesopotamian Fauna'. The present state of Europe has made it impossible to complete the zoogeographical analysis of the desert insects here recorded, and I have therefore excised the zoogeographical sections, as the change in the title indicates; the analysis will, it is hoped, appear later, together with one or two additions to the list of species not yet determined. The present article is thus a truer companion to those already published about Iraqian lepidoptera, viz: 'Lepidoptera of a Bagdad Orchard' (*Ent. Rec.* Feb. 1939), 'Autumnal Lepidoptera in Kurdistan' (*Ent. Rec.* Aug. and Sept. 1937) and 'More Notes on Kurdish Lepidoptera' (*Ent. Rec.* July and October 1939).

Iraq became dry land this alluvial plain was a barrier to some of those steppe species that inhabited the western and eastern shores of the former Gulf and prevented the races which had there grown up from any re-admixture. This explains the eastern and western Iraqian races of *Euchloe charlonia* and *Zegris eupheme*.

The alluvial plain is composed of a light calcareous loam, unusually rich in lime, and in many places salty,—the eroded waste of the limestone hills of Armenia and Iran. This soil forms a fine dust when dry; frequent strong winds scour its surface; in the spring it is liable to extensive inundation, and the lakes so formed usually stand for months, and sometimes for a year, but eventually dry up. Such conditions are particularly unfavourable to animal and vegetable life. The upland desert, however, (gypsum, conglomerates, sandstone, etc.) is a scorched steppe and boasts a more varied vegetation, its stony soil providing plants with a firmer hold and rocks and in places cliffs giving shelter to the more sensitive kinds. After rains, the desert blossoms, sometimes becoming a mass of colour for a short period; on the other hand, standing pools quickly drain away. Such are the conditions responsible for the greater richness of the upland desert fauna. Similar causes also operate to favour the desert hills of the south-east. In southern Iraq and Khuzistan a degree of confusion between the alluvial desert and the marshes occurs and the higher humidity of these parts also enriches the desert-fauna to a certain extent. The foothills of the Zagros however lack this ambiguity and prolong our desert area, on the east shores of the Persian Gulf, towards India. The mountains and coastal plain here however enjoy a more humid climate than the northern and western fringes of our area, while remaining typically desertic. The true boundary of our desert area along the whole length of the vast Zagros chain is the lowest limit of the woodland zone, though in many places deforestation has obscured its whereabouts; that is, at about 1,500 feet in the north, (Kurdistan) and at about 3,000 feet in the south (Fars). The easterly offshoots of the Taurus, and the southward-running Lebanon range may be said similarly to demarcate this vast desert in the north and west; I am unable here to discuss the Anti-Lebanon and Transjordanian hills which are steppe-like and resemble the Persian mountains. Just as the Mesopotamian desert's ground rises slowly northwards towards Mosul, so the Syrian desert rises imperceptibly but steadily westwards towards Palmyra and Damascus; in fact one could say the same of all Arabia. Climatic conditions therefore obviously must differ at different localities in the Arabian-Syrian-Mesopotamian desert, but the translation from the low desert with mild winters to the high with regular snowfalls is gradual. In no part however is the area as high as the high steppes of Anatolia and Iran; and even the latter, of course, are not in the same class as the Russian steppes, which are covered with deep snow during a longer winter, and, indeed sometimes enjoy summer rainfall. There is comparatively little sand in those parts of the desert with which this article deals,—certainly nothing to compare with the dunes of Arabia or the Sahara.

The Desert Insects.

The list which follows is one of species of lepidoptera taken by myself during the last five years. I have endeavoured to confine it to desert-species, leaving those characteristic of other biotopes to be dealt with elsewhere; in a word, it deals with an ecological category of insects, not with a zoogeographical category; for the former, I use the word 'desert-species' or 'desert-insect' (just as I use 'desert-tree' and 'desert-animal')—meaning one regularly found in the desert, whereas for the latter I use the term 'eremic'.

Desert-insects, by the above definition, are those for whom the desert is a means of distribution; they may feed on desert plants, or, breeding elsewhere, may be regular migrants over the desert. But desert-flora itself varies locally, not only according to the latitude and altitude, but according to the nature and the drainage of the soil at any one place. Certain valleys or quite shallow depressions, which are not oases because they contain no wells, no cultivation, and, except immediately after heavy rains, no surface water, nevertheless boast a denser and more varied vegetation, and consequently a richer insect-fauna, than the surrounding ground. Such flora and fauna must be regarded as of a desert kind. It is however rare to find tamarisks growing in the Mesopotamian desert except where there is perennial surface-water, and I class the tamarisk as an oasis-tree here. In other deserts this may not be so. The nebek or sadr tree (*Zizyphus Spina-christi*) however must be considered a true desert-tree of our area, though limited only to certain parts of it, in the south. One might also include the wild pistaccio (*Pistacia mutica*) as a desert-tree of Mesopotamia, for it is still to be found on the Jebel Abdul Aziz, Jebel Sinjar, and some of the hills between Raqqa and Palmyra, and once grew on other desert-hills in N. Iraq, its disappearance from which is probably due to centuries of charcoal-burning; no entomologist has however visited these desert-mountains where the tree still grows, so I do not here record the species usually associated with this tree, such as *Thaumetopoea solitaria* and *Oulobophora externata,* which one might expect in these places. Perhaps these surviving trees are the relics of a woodland which in the several pluvial periods of the Pleistocene Age may have covered a great deal of the desert.

Oasis-insects, if not also desert-insects, are excluded from this paper:—i.e. those species biologically dependent on poplar, tamarisk, fruit-trees, crops, shady undergrowth, or marsh-plants, which do not also migrate over the desert. They are treated in two separate papers, one concerned with the orchard species, the other with the river species. The first of these papers is quoted in footnote (1), p. 826 while the second, dealing with the insects attached to tamarisk and Euphrates poplar, has not yet been published.

Such plants as *Alhagi camelorum* and *Prosopis stephaniana*, which are typical desert-plants, thrive also in oases; similarly many true desert-moths are to be found breeding in numbers in oases. Oases therefore are much more ambiguous biotopes than the desert, in which one finds few species from other biotopes, and those few wandering intruders.

The ecology of desert-insects has been ably discussed by Buxton[1], Bodenheimer[2], and Amsel[3], so no detailed account of it is here called for. Suffice it to say, that insect activity is concentrated in the early summer and autumn, the two seasons when the climate is most favourable, with larval activity in late autumn and spring. Between these two active periods come the winter and summer pauses, during which imaginal flight is much rarer. *Ocnogyna loewi* is the principal winter moth, while *Zizera galba* and several Cossids are the most successful midsummer fliers. Rootfeeding or diurnally subterranean larval habits enable many species to appear in the utmost profusion as adults, even in the most dry and torrid parts of the desert.

The facies of desert insects is in general lighter than that of lepidoptera from colder and moister climes. Bold disruptive colouring appears on the wings of several species, though not so frequently as on the Iranian plateau; more frequently black bands on a white hindwing form a striking contrast to 'desert-coloured' forewings, and operate as 'flash' colouring in flight. Dayflying is more frequent in the Agrotidae than in less hot climates. Metallic gold or fiery-brown markings on a white satin ground, are another colour-scheme favoured by the representatives of unrelated families. A desert-collector's cabinet thus recompenses him, by its attractive contents, for the cheerless scenery in which he collects.

The Agrotidae and the Pyralidae are the families of Lepidoptera best represented in the desert. Geometridae, which are to a large extent a wood-loving family, are comparatively few.

While many of the desert-species in the list have vast range, there are one or two notable local species (e.g. *Lithostege buxtoni, Armada leprosa*) which seem only to range from the Iranian plateau to the plains below.

A brief summary of the faunistic affinities of the desert-species was given in my article 'Insect Biotopes in Syria Iraq and Iran' (*Ent. Rec.* April 1940), anticipating the analysis referred to in footnote (1).

Description of Localities.

1. Mosul Desert (M. D.)

The exact place is Kharbat al Bayadir near Tel Hawa, 1,200 ft.; undulating steppe-desert between Jebel Sinjar and the Turkish foothills. Inhabitants, Shammar Arabs. Visited in vi-viii, 1935.

2. Mosul (M).

Similar country, 700 ft., on the banks of the Tigris. There is practically no irrigation here, but in places spring barley is grown. Visited, mid-v to ix-35, and x-36. Inhabitants mixed Arab, Kurd, and Christian (Semitic).

3. Fatha Gorge (F. G.)

The Tigris here breaks through the Jebel Hamrin, a ridge whose height is nowhere more than 600 ft. No cultivation or river trees. A brief day-time visit 30-iii-36. Arabs.

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[1] *Animal Life in Deserts* by P. A. Buxton, London, 1923.
[2] *Animal life in Palestine* by F. S. Bodenheimer, Jerusalem, 1935.
[3] *Die Lepidopteren Palastinas*, by H. G. Amsel; Zoogeographica Oct. 1933.

4. Baiji (Bi.)

A few miles S.-W. of 3. Open steppe-desert. A single night, at the pipe-line station, 1-x-36. Arabs.

5. Haditha (H.)

At 400 ft., in typical Syrian-desert country, a mile or two east of the Euphrates. One night at the pipe-line station, 30-ix-36. Arabs.

6. Palmyra (P.)

In the centre of the Syrian desert. Height, 1,300 ft. Visited on two nights, 7-iv-34 and 29-ix-36, the latter visit being to station T. 3 on the pipe-line. Arabs.

7. Table Mountain (T. M.)

The Dyala here breaks through the Jebel Hamrin. Height, 200-400 ft. Visited several times in iii and iv-36. No cultivation. Arabs.

8. Qaraghan (Q.)

The Dyala here flows between low hills and plateaux, the foot-hills of the Zagros. Close by is the similar locality of Qizil Robat, where Peile took many of the butterflies described in *Journ. Bombay N.H.S.,* Dec. 1921 and March 1922. Quite similar to 7. Visited in iii-37. Arabs and Kurds mixed.

9. Jebel Darwishka (J. D.)

Height 750 ft. (*Fasilah Pass*). The road here passes over one of the foot-hills mentioned under 8, before dropping down to locality 10. Bare arid hills of conglomerate. Visited, iii-36, iii-37, and xi-xii-36. Arabs and Kurds.

10. Khanikin (Kh.)

On the Dyala, between 9 and the Zagros. Some palm-gardens and other cultivation on a narrow alluvial strip between stony hills and plains. Visited same times as 9. Arabs and Kurds.

11. Naft-i-Shah (N. S.)

On the Persian side of the frontier, but similar country to localities 8, 9, 10, and adjacent to them. Visited on one night, 14-xi-39.

12. Bagdad (Bd.)

Alluvial plain, irrigated by lift from the Tigris. 100 ft. Was collected in all the year round. Orchards, gardens, and river trees make this a very ambiguous locality. Arabs.

13. Seleucia (Sa.)

In the alluvial plain, near Bagdad. Irrigated crops, but few trees. Arabs.

14. Kerbela Desert (K. D.)

Steppe desert, 600 ft., more arid than the Mosul Desert, but even so with some thick patches of local low vegetation. The actual locality is 150 miles west of Kerbela, 20 miles north of Nukhaib Post, at Habbariyah well. I visited this place for two nights in late iii-37, and from that date until vi-37 Mr. Diamond, who was in camp there, collected regularly for me everything that came to light. This material therefore gives a fairly complete picture of desert moths in this area flying before the midsummer pause. Anizeh Arabs.

15. Ukhaider (U.)

Similar to 14 but rockier. 400 ft. 50 miles west of Kerbela. A fine ruined castle is the focal-point for butterflies here. A short daylight visit, 29-iii-37. Anizeh Arabs.

16. Nejf (N.)

400 ft., steppe desert, even more arid than 14. Arabs. Visited, 26-III-37.

17. Salehabad (S.)

Irrigated steppe desert, a flat plateau at 600 ft. Near Dizful, Persia. Also called Andemeshk. Visited on single nights, 4-iv-38, 29-x-38. Bakhtiari winter quarters.

18. Ahwaz (A.)

A ridge of sandstone outcrops from the alluvial plain of Khuzistan. Height, 200 to 400 ft. With a south wind, the climate can be very humid; the winters are also milder than most of the preceding localities. Was collected in during iv, v, vi, viii, ix and x-38. Population, mixed Arab and Persian. The river Karun breaks through the ridge, and provides water for a certain amount of cultivation. Some nebek trees.

19. Maidan-i-Naftun (M. N.)

Arid limestone and gypsum hills (c. 1000 ft.), with considerable low herbage, and water in the principal valleys. Visited 5-v-38. Bakhtiari Inhabitants.

20. Bushire and Dalaki (Bsh. & D.)

Though my collecting in Farsistan is not concluded yet, it will not be out of place to add to this article several records made at and near Bushire in xi-40. Bushire is a low peninsula of mixed sand, gypsum and sandstone, with a certain number of nebek, *Prosopis* and other trees. The Filfil Pass near Dalaki, is a completely arid but hilly locality, 800 ft. in the lowest Zagros foothills. Both these localities are unpleasantly hot and humid in summer, pleasant in winter. Inhabitants, of mixed race.

The initials in brackets are used as abbreviations for the above localities in the following records.

P., H., K. D., U., and N. are west of the Euphrates.

T. M., Q., J. D., Kh., and N. S. might be regarded all as one locality, and they, together with S., A., M. N., Bsh. and D. are east of the Tigris and subject to a strong Iranian influence.

The localities are given above in order north to south.

M. D., and M. are well north of the limit of palm-cultivation, while F. G., B., H. and P. lie slightly north of the limit.

Specimens collected at Kh., Bd., Sa., S., and some of those at A. were taken on ambiguous ground (i.e. oasis and desert fauna), those at M, M.N., and Bsh. on slightly ambiguous ground; the rest of the localities collected at were unrelieved desert.

List of Desert Lepidoptera.

(Taken by the author at the above localities).

If no locality is indicated for an insect below, it may be taken that that species is generally distributed in the whole area.

Rhopalocera.

Papilio machaon L. **centralis** Stgr.

On low foot-hills, at Q, etc., in spring.

Zegris eupheme Esp. **tigris** Riley and **dyala** Peile.

The form *tigris* occurs from Transjordan eastwards into Iraq where F. G., east bank of Tigris, is its easternmost known limit. The Jebel Hamrin, however, on which it breeds and flies, extends hence without interruption into the territory of the other form, *dyala*, which, first taken near Q by its author, flies also on J. D. and extends thence south-eastwards into Farsistan, where Brandt took it at about 2,550 ft.

Detailed information about this and other butterflies was given by Peile, *loc. cit.*, so I abbreviate my comments on this and other Rhopalocera, to avoid repeating.

Short migrations have been recorded of this species but it cannot be a long-distance-migrant.

Glycestha aurota Fab. **(= mesentina)**

This species passes the winter as an imago in the low hills around Q, and thence south-eastward.

Euchloe ausonia Hbn. **persica** Verity.

Euchloe belemia Esp.

Euchloe charlonia Douz. **mesopotamica** Stgr. and **transcaspica** Stgr.

The bright yellow form *mesopotamica* occurs at U., while the whiter *transcaspica* flies in iii and iv at T. M., Q., and J. D., and thence into Fars where Brandt took it with *dyala*. Pfeiffer regards this race as distinct from *transcaspica*, to which Riley and Brandt attribute it.

Pontia daplidice L.

Pontia glauconome Klug. **iranica** Bien.

Colias croceus Fourc.

Noted in the Iraqian plain in every month except viii and ix.

Teracolus fausta Oliv.

Catopsilia florella F.

At J. D. and F. G., in iii and iv. Perhaps not every year, for Peile did not record it.

Eumenis telephassa Hbn.

Eumenis persephone Hbn.

Eumenis pelopea Klug.

The third of these species I only found at M.D., but the others are wide-spread.

Pyrameis cardui L.

On the wing all the winter, but less seen in summer than *croceus*, the other migrant which breeds here. Foodplant: malva parviflora, etc.

Melitaea trivia Schiff.

Not seen on the alluvial plain.

Danais chrysippus L.

At B'd. a garden insect, feeding on *Asclepias curassavica,* but associated with *Calotiopis procera* in the desert in the south-eastern corner of our area.

Chilades galba Led.

Chilades trochilus Frey.

Tarucus theophrastus Fab.

Tarucus mediterraneae B-B.

Tarucus balkanicus B-B. **areshanus** Frr.

At Bagdad the nebek is an oasis-tree but in the south-east corner of our desert area it grows in the desert, accompanied by the above three species.

Hesperia geron Wats. (det. Evans).

Three dwarf specimens near A, 16-x-38.

Eogenes alcides H. S. **elama** Wilts.

M. N., 6-v-38. This remarkable local form [1] differs in having the less-pointed forewing unmarked except for three small contiguous apical spots in spaces 6 to 8.

Adopaea thaumas Hufn.

M. N., in V.

HETEROCERA.

Syntomis aurivala Schaw.

This rare species has been re-taken at Abu Wajna near Mosul, on 7-v-29, by Yusuf Lazar, the collector for the Field Museum Chicago. I do not know the exact whereabouts of this locality.

Utetheisa puchella L.

This species breeds in Iraq. Commonest in autumn.

Ocnogyna loewii Z.

Widespread except on the alluvial plain.

Axiopaena maura Eich.

One perfect specimen indoors at Bsh, in v-40, a most surprising date, since I had previously only taken the species in the autumn in the Kurdish hills. Watkins (in *Journ. Bombay N. H. S.,* Dec. 1921) recorded a specimen of *Lasiocampa grandis* taken at Amara in May 1917. Until my capture of *maura* I almost inclined to think that that date was an error, but it may be that certain species, normally autumnal, regularly emerge in early summer in very torrid desert localities and perhaps aestivate. The perfect condition of my *maura* was in strong contrast to the usually ragged condition of this moth in the hills in autumn, and this suggests to me that perhaps the specimen was sexually immature, and that aestivation plays a part similar to hibernation in *Vanessa urticae* in England. I have however no proof that aestivation takes place, nor has the specimen been dissected. But these two records certainly raise a point which desert collectors should not lose sight of. (I have taken *L. grandis* at 5,000-6,000 ft. near Shiraz in the autumn, thus confirming Watkins' record. Its occurrence at Amara and Shiraz would make it probably eligible for inclusion in this list as a desert-moth.)

Chondrostega aurivillii Pungl. **feisali** Wilts.

Bi., H., Q., and near A. The male comes to light in early x, and the larva often swarms in iii and iv.

This form (1) is about the same size as *fasciana* Stgr., which is probably conspecific, but with a white ground colour, and brown median and sub-marginal bands, which often almost vanish. Typical *aurivillii* are apparently more heavily marked and smaller. In Arabia an extreme development of *feisali* occurs, in which the wings are pure white and unmarked. The larva is described in the full description referred to in footnote (1), p. 826.

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[1] A full description, with photographs, of the two new forms *elama* and *feisali* is being published elsewhere; but if these should prove not to have priority the above brief descriptions must be taken as the preliminary but valid ones.

Chilena proxima Stgr.

The commonest Bombyx in Iraq, and a characteristic insect of the Mesopotamian desert, from the Turkish foot-hills to Khuzistan. The pretty lackey caterpillar, described at length and figured in *Ent. Rec.*, June 1940, feeds in rapid successive broods on *Prosopis stephaniana.*

Celerio lineata livornica Esp.

Two broods occur in spring and early summer, and the larvae are often to be seen in profusion in the desert at that season; the imago sometimes appears in the autumn. A well-known migrant.

Macroglossa stellatarum L.

A well-known migrant.

Dyspessa asema Pungl. (det. le Cerf)

Two specimens at K. D. in early v.

Dyspessa wiltshirei Dan.

Q., 14-iii-37; the types.

Stygia saharae Luc. **(det.** le Cerf.)

Common to light, M. D., vii-viii. This is the first record of this species outside Africa.

Holcocerus gloriosus mesopotamicus Watk.

Most variable in extent of markings and size. Common to light at K. D. from 20-v to 20-vi-37. A single specimen taken at A on 16-viii is apparently *f. laudabilis* Stgr., which I have little doubt is the Palestinian form of this species, and not a distinct species.

Bryophila divisa oxybiensis Mill.

M.D., in v.

Bryophila tabora Stgr.

Bryophila probably **eucta** Hamps.

These two species were taken at M., 3-x. Stone is plentiful here, but desert conditions in most other localities do not favour this genus, which feeds on lichen, so it is not surprising that I only took representatives in the north.

Euxoa conspicua Hbn.

Common in iv-v, and again in ix-x; widespread except in alluvial plain.

Euxoa canariensis Reb. **diamondi** Brsn.

18-iv-37, K. D. (the type of the subspecies.). The same form of this widely distributed Eremic species has been taken by Brandt in Fars.

Agrotis segetis Hbn.

Agrotis ypsilon Rott.

This species seems to appear, in the desert and oases of the Mesopotamian plain, only in the cooler months between ix and vi. It has been suggested that a migration to higher ground accounts for its summer absence, but this suggestion seems to me to be unnecessary, aestivation being so frequent in lepidoptera in the desert, though I have certainly taken it on the wing in high mountains during those months when it is not to be seen at lower elevations. The same seems to be the case with *segetis* Hbn. These species that fly continuously during the cooler months are not in the same class as those

which have two distinct generations, in autumn and spring, such as *Dyscia plebejaria, Elaphria bodenheimeri*, and *Cornifrons ulceratalis*.

Agrotis crassa golickei Ersch.

Golickei is perhaps an oasis-insect at Bagdad, but further north seems to be a true desert habitant. Autumnal.

Agrotis flavina H. S.

This species, typical of the high steppes of Turkey and Iran, occurs in the desert only at the higher elevations, e.g. M., 18-v-35. I have also taken it, in the Bekaa (Syria), and at Hamadan and Tehran, and Brandt has recorded it from as far south as Farsistan.

Agrotis puta Hbn.

Kh., 27-xi. Also at Kirkuk in iii-36.

Agrotis (Powellinia) lasserrei Ob.

The reddish hue of Iraqi specimens seems to put them closer to N. African than Central Asian forms. Very common in xi on both alluvial and stony desert.

Agrotis (Powellinia) matritensis Vasq.

Bsh. 21-23. xi. These examples have rather dark grey hindwings: males: to light. (Also taken at Bi. by Peile, 1919).

Agrotis haifae Stgr. (det. Brsn.)

J. D., 7-x. Boursin gives as synonyms or races of this species: *hoggari* Roths., *securifera* Tur., and *saracenica* Tams.

Rhyacia flammatra Schiff. **centralasiæ** Wagn.

A steppe insect, with a similar range to *flavina* (*vide supra*) M. and M. D., in v, vi, and x.

Rhyacia taurica Stgr. (b. sp.) (det. Brsn.)

M., x-36.

Triphaena pronuba L.

K. D., iv.

Actinotia hyperici Schiff.

M. D., in vi.

Polia consanguis Guen.

P., 30-ix.

Pronotestra silenides Stgr.

K. D., iii.

Scotogramma trifolii Rott. (= **taylori** Roths.)

Discestra arenaria Hamps.

A, late iv and x, 38, with a partial brood in captivity in v. The larva was described and figured in *Ent. Rec.* June 1940.

Discestra eremistis Pungl.

Near A, 14-x-38. Boursin wrote of this example: 'Si ce n'est pas *eremistis* c'est *vaciva*; mais du point de vue biogéographique, c'est la même chose.'

Cardapia sp.

P., 30-ix.

Hphilare loreyi Dup.

Brachygalea albolineata Blach.

One specimen, 5-iii-37, Bd. Previously only known from Tunis and Algeria.

Cucullia boryphora F-Wald. (det. Boursin).

K. D., iii- and iv-37. Known from Central Asia, S. Russia, Armenia and Anatolia, and, according to Boursin, 'probably the same as the Spanish *achillea* Guen.'

Cucullia strigicosta Brsn.

The types were reared from larvae found on the ridge of J. D. in iv-36, hatching in iii-37. Foodplant, *Scrophularia.*

Cucullia wredowi Costa (det. Boursin).

T. M., Bd, Sa, and A. Also on the Iranian high plateau, and known from Anatolia, Italy, S. France and N. Africa. The larva of the Iraqi moth differs recognisably from that of the Lebanese *wredowi-judaeorum* Strand.

Lithophasia = (Hypomecia) quadrivirgula Mab. (det. Brsn.)

Three females to light, J. D., 14-xi-36. They belong to the N. African form, not to the Palestinian, *jordana* Stertz.

Copiphana gafsana Blach. (det. Brsn).

K. D., 28-iii-37. Previously only known from Tunis.

Metopoceras delicata Stgr. (det. Brsn).

The rather dark-rose female from T. M. was determined by Boursin as this species, and not as *pilleti* Brsn, which I thought it was on catching it. The type of *pilleti* was taken at Deir es Zor, on the Euphrates (Syria) from which I have ordinary specimens of *delicata.* Only one female of *pilleti* has ever been caught and I suspect it to be an extreme aberration of *delicata.* The T. M. example was taken in xi, and a series from K.D. (1-v-37) is paler, and more typical.

Metopoceras omar Ob.

The form *caspica* Alph. certainly occurs in Iraq but this name cannot be used, as by Rothschild, to describe the race. The species varies here from ash-grey to deep red-brown. I infer that there are two consecutive spring broods from the following records: T. M., 13-iii-37, a very varied series; K. D., 1 to 6-v-37, a paler, less varied series. Common at A. in iv. Brandt refers his *Farsistan* examples to *felix* Stfs.

Cleophana pectinicornis Stgr. (det. Brsn).

A common spring moth on the stony desert, previously only known from N. Africa.

Cleophana jubata Ob. (det. Brsn).

A N. African species, flying in Iraq commonly together with *baetica* Q, K. D.

Cleophana baetica diluta Roths.

T. M., Q, K. D. Common to light in iii and iv. Also known from Spain, N. Africa, the Taurus, Georgia, and Farsistan.

Calophasia pampaninii Krug.

K. D., 31-iii-37, one. Previously only known from Cyrenaica.

Metalopha liturata Chr.

S, 4-iv-38.

Acrobyla kneuckeri Rebel.

Two, in iv at A. The type being inaccessible, the species has been determined according to the British Museum's examples from Arabia. The Ahwaz form is darker than these, though closer to them than to *ariefera* Hamps.

Derthisa lederi Christ.

Kh., in xi. Commoner a little earlier higher up in the Zagros range.

Aporophila nigra ssp. n. **dipsalea** Wilts.

This remarkable desert form (perhaps also occurring in the Zagros hills) differs from the typical by its lighter, 'drier' coloration. Forewing, above: pale wood-brown, with a somewhat obfuscated median area, and a narrow dark grey marginal shade, approaching which the nervures become dark grey also. Lines, clear, outlined in sooty brown. Orbicular stigma, with grey centre and pale outline; reniform, similar, the distal outline being whitish. Fringe, smoky grey with lighter brown interruptions at the nervures. Underside, greyish white with a pale coppery glint; nervures and post- and antemedian lines distinctly outlined in faint brown; reniform stigma, darker brown; fringes darker brown. Hindwing (male) white, with nervures marked in pale brown and margin in rather darker brown. Expanse, 40 mm.

Holotype, ♂, 14-xi-39, Naft-i-Shah. In coll. m.

The distinctly brownish race found in the Lebanon seems to be an intermediate between the normal and the desert forms, and is larger than *dipsalea*, spanning 46 mm.

Antitype canescens Dup.

This typically Mediterranean moth also flies commonly in autumn in the Zagros up to at least 5,000 ft. (Kermanshah and Shiraz), but also comes down to the lowest desert: Bsh., and D., late xi. The larva is here polyphagous, but especially fond of *Calendula*.

Autophila limbata Stgr. (det. Brsn).

M. D., vi-35.

Autophila cerealis ssp. **amseli** Drdt.

A, K. D., common in iv and v, the 10-footed larva feeding on *Salvia*.

Autophila cymaenotaenia Brsn. ssp.

K. D., 4-v-37, one.

Apopestes spectrum Esp.

M. D., in vi. In the Lebanon, it flies in ix, at Suleimani (S. Kurdistan) a specimen was taken in xii; at Hamadan, it first emerged in early vi. I have never seen any sign of second-brood larvae, and believe the late Suleimani date can be explained by its habit of long rests and ultimate hibernation indoors. In Mediterranean areas it feeds on Spanish broom, but in the interior of Iran I have found *Glycyrrhiza* bushes amidst cultivation infested locally with its larvae and cocoons. This is probably its chief foodplant in Mesopotamia.

Tathorhynchus exiccata Led.

K. D., 14-iv-37, one.

Scythocentropus inquinata Mab.

P., 30-ix. Previously known from Tunis.

Pseudohadena chenopodiphaga Ramb.

Prodenia litura F.

Hypeuthina fulgurita Led.

Kh. and Bsh., xi. At 3,000 ft. in the Bekaa (Syria), at coast-level in the Lebanon, at about 2,000 ft. in Kurdistan, and at 3,000 ft. in Farsistan (Shapur), this species is associated with *Stilbina hypaenides* Stgr, which flies with it, but I have not yet taken *hypaenides* in the desert proper, unless Shapur (an intermediate locality) be considered such.

Rhabinopteryx subtilis Mab.

K. D. and Bd., iii.

Laphygma exigua Hbn.

Elaphria clavipalpis Scop.

Elaphria bodenheimeri ssp. **chlorotica** Brsn.

M, Q, J. D., Kh., S and A. The autumn brood (x and xi) is very numerous; the spring brood, which consists of larger specimens, is the reverse. (iii and iv). This race comes closer to the Iranian race (*plesiarchia* Brsn) than the nominotypical Palestinian-Lebanese race, and indeed fuses with the former by transitional forms difficult to assign to either.

Elaphria flava Ob. (det. Brsn).

K. D., 27-iii to 11-iv-37. Boursin considers old records of this species from Palestine an error for *bodenheimeri*, which had not then been described. These are the first sure records out of N. Africa, and its occurrence in the southern desert parts of Palestine seems likely after all.

Elaphria belucha Swinh. b. sp. (det. Brsn)

P., M, and Kurdistan, in x. The type came from Quetta.

Catamecia minima Swinh.

A, 7-v and late x. The relation of this Sindian species to congeners described from Palestine and N. Africa requires further investigation.

Pseudathetis fixseni Chr.

A, in iv and again more commonly in x.

Dysmilichia bicyclica Stgr. (det. Brsn).

One, Q, 13-iii-37. Also at Tehran, ii-v-39, on hilly steppe at 5,000 ft., a quite waterless locality.

Hadjina viscosa Frr.

A, 27-iv, and 6-v-38.

Aegle ottoi Schaw.

Originally described from near M, I have a short series of this species from K. D., taken in v, and a longer series from A, taken in late iv. The markings vary somewhat in intensity.

Aegle rebeli Schaw.

M. D. and M. in v; M. N., 5-v-38. Also Kurdistan.

Metaegle pallida Stgr.

M. D. and M, common in v and vi. Also Kurdistan.

Chloridea peltigera Schiff.

Chloridea obsoleta Fab.

Chariclea delphinii f. **darollesi** Ob.

M. D., one (3-vi-35).

Aedophron phlebophora Led.

M. D., in vi and vii. This and the foregoing species only occur at the higher levels of the desert.

Porphyrinia parva Hbn.

Porphyrinia albida f. **peralba** Schaw.

Of this form, probably the Iraqi subspecies, described from M, I have two examples from K. D. (4-v-37).

Glaphyra lacernaria Hbn. **cretula** Frr.

M. D., vi- 35.

Tarache biskrensis Ob. **orientalis** Brdt.

Bd., K. D., A., iv and early v.

Tarache lucida Hfn.

At A it was noted that the specimens flying in iv were typical, while those flying in v and the autumn were f. *insolatrix* or f. *albicollis* F. It is generally distributed.

Anua tirrhaca Cr.

P., iv-34. Cannot occur far from the wild pistaccio tree.

Mormonia neonympha Esp.

M. D., early vi.

Anophia sp.

M., 10-vii-35.

Cortyta vetusta Walk. or **profesta** Chr.

Pericyma squalens Led.

Pericyma albidentaria Frr.

Cerocala sana Stgr.

I have only taken the autumn brood, which shewed considerable variation, but, on the whole, had less yellowish hind wings than Beirut specimens. Flies near A, in x.

Leucanitis kabylaria B-Haas.,

A., 21-iv and 16-x.

Syngrapha circumflexa L.

Phytometra gamma L.

Phytometra ni Hbn.

Raphia cheituna Brdt.

I took three examples of this species, recently described from Bander Abbas, at Bsh., in late xi-40.

Pandesma anysa Guen.

M. (vii-ix), Bd. (ii-ix), K. D. (10 to 26-vi-37). The larvae were found in great numbers on *Populus euphratica* in iii and iv on an island in the Tigris. The main emergence at Bd occurs at the end of iv though odd specimens are seen earlier; larvae and imagines then continue to be found, at Bd, throughout the summer. At K. D. (far from the river), the species appeared in great numbers at light in vi, but not a single specimen before. The inference is that it can only breed continuously on the cultivated riverain tracts, and that desert examples are emigrants from such breeding grounds. A specimen was taken in an Elburz river valley at about 5,000 ft. on 28-v-39.

Anumeta spilota Ersch.

K. D., in early v.

Anumeta major Roths.

A., 26-v-38. This species may be the same as *spatzi* Roths.

Aleucanitis flexuosa Men.

Armada leprosa Brdt.

D., 25-xi. Common about two months earlier at 6,000 ft. on the Bushire-Shiraz road.

Armada panaceorum Men.

A common insect from mid iii to early v on the stony desert. The eastrnmost localities (T. M., Q, etc.) seem to produce slightly browner specimens than the Syrian-Arabian desert side.

Armada hueberi Ersch.

Common to light along the Kurdish-Persian foothills, from T. M. to A. (iii and iv).

Armada ornata Brdt.

16-x-38, near A. A Persian species.

Rhynchodontodes revolutalis Z.

Very common along the river valleys but occurring also in unrelieved desert, in bushy places. I consider *eremialis* Swinh. and *syriacalis* Stgr. synonyms of this species, which thus ranges from Sind to Egypt, perhaps further west. The type of *revolutalis* is in the British Museum, and came from South Africa! There is no other specimen like it from S. Africa in the Museum collection, rich though it is in S. African material.

Pingasa lahayei Ob.

A., 22-v., and Bsh., late xi. Probably associated with the *Zizyphus* (nebek) tree.

Neromia pulvereisparsa Hamps.

N. S., 14-xi-39. Known from Aden, the Persian Gulf, and Palestine.

Microloxa herbaria Hbn. **advolata** Ev.

K. D., v-vi.

Rhodometra sacraria L.

M. D., vi; A: larvae on wild *beta* in hollows (the more usual foodplant is *Polygonum*).

Scopula beckeraria Led.

A characteristic insect of the poor steppes of the Middle East, appearing in a spring and an autumn brood. It is commoner at higher elevations, but occurs in the desert: Kh., xi; A., x.

Glossotrophia asellaria semitata Prt.

K. D., v; M. N., v; M. D., vi.

Lithostege palaestinensis Ams. ssp. n. **ali** Wilts.

Rather resembles *griseata* than the nominotypical form from Palestine, being darker grey, especially the hindwings. Varies somewhat in size. This must be the same species that was recorded in 1921 by the *Bombay N.H.S.* as *farinata*. It flies in iv and v at practically all the localities from F. G. southwards. At K. D. and N dwarf forms occur, doubtless due to the great aridity of the desert here.

Lithostege notata B-Haas.

T. M. (14-iii-36), one.

Lithostege dissocyma Prout.

The type was taken at T. M. on 14-iii-36. It laid eggs but I failed to persuade the young larvae to feed. No other specimen has yet been taken.

Lithostege buxtoni Prout.

One of the two types came from Shergat, a stony locality near Bi. The other came from between Kermanshah and Hamadan, Iran (c. 5,000 ft.) I have taken examples at Suleimani (Kurdistan), Kermanshah and Shiraz in xii.

Eupithecia tesserata Brdt.

A., iv. A common insect in Farsistan.

Macaria syriacaria Stgr.

Widespread, common in oases, but also a habitant of the unrelieved desert. Larva feeds on prosopis stephaniana and was described in *Mitt. Muench. Ent. Ges.* 1939, Heft 1.

Dyscia plebejaria Ob.

The typical Saharan form occurs at M. and K. D., in a spring and autumn brood.

Gnopharmia erema Whrli.

In early v at K. D. and M. N.

PYRALS AND MICROS.

The determination of these is not yet complete, so they are omitted *in toto* from this paper.

DOUBTFULLY DESERT SPECIES.

The following were taken at ambiguous localities, and not enough is known about them yet for one to attribute them with certainty to the ecological classes of desert-insects.

Taragama siva Lef.

This Indian species reaches as far as Bagdad, where it is chiefly attached to river and garden trees (*Populus euphratica*, apple, willow, pomegranate,

tamarisk) but also feeds freely on the small thorn *Prosopis stephaniana* on cultivated ground. There seems no reason why it should not accompany this thorn into the unrelieved desert, but the fact remains that the moth has not yet been noted there. In Bsh., and S. Mesopotamia it feeds on the *Prosopis* tree.

Dyspessa bipunctata marginepunctata Wilts.

A., iv-38. This is the only place in the desert where I have taken this species, common higher up in the Zagros range. Its early stages are unknown. Another species of *Dyspessa* was also taken near Ahwaz but has not yet been identified.

Agrotis exclamationis

M., 25-vii-35, one only.

Elaphria zobeidah Brsn.

M., Bd. in iii and x. It also occurs in high Persia.

Spodoptera latebrosa Led.

A., in iv and ix. Bsh., in xi.

Chloridea nubigera H. S.

A., 2-v.

Leptosia velox rubescens Schw.

M. N., 3-v-38.

Thermesia arefacta Swinh.

Like *siva,* feeds on *P. stephaniana* and has only so far been taken on irrigated ground or river-sides. Bd., and near A. Late summer and autumn.

Chloroclystis lita palearctica Brdt.

A., 28-iv.

Zamacra flabellaria Heeg.

Bd., 18-xii-35. Peile also took a series at Mirjana, on the Dyala near T. M. and I do not know if this locality was or was not ambiguous.

TWO NEW NITELLAS.

BY

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Presidency College, Calcutta.

(*With 2 plates*).

In the present paper two new Nitellas have been described. For *N. pseudotenuissima* I am indebted to Dr. H. Chaudhuri of the Punjab University who kindly placed at my disposal the specimens collected by Prof. Dewan Mohindranath, a former student of his, from a shallow tank at the foot of the Murree Hills. I take this opportunity of thanking Rev. Father Pew of St. Xavier's College, Calcutta, for the Latin version of the descriptions.

Description.

Nitella pseudotenuissima sp. nov.

Arthrodactyla homoeoclema conoteles subflabellata gymnocephala macrodactyla monoecia.

Caulis tenuissimus, 235-305 μ crassa, non incrustata, verticilli duplicis generis: principalis caulis radiantes et dispersi atque ramorum maxime congesti et moniliformes; ambo fertiles, generaliter tantum unus ramus ad nodum caulis. Ramuli caulis sex ad nodum et semel vel bis furcati, radii primarii 2/5 longitudinis ramuli, radii secundarii 6, raro 5; sex secundariorum radiorum quatuor iterum dividunt in 2-4 ultimos radios et inequales longitudine sunt. Parviores verticilli cum ramulis brevissimis et capitibus densis, ramuli generatim 6 ad nodum, 2-3-furcati, primarii radii circiter $\frac{1}{3}$ longitudinis totius ramuli, radii secundarii 4-5, radii tertiarii 3-4, tantum unus vel raro duo tertiariorum radiorum divident in 3 vel 4 ultimos radios. Dactyli bicellulati, apex penultimae cellulae rotunda apicis cellula conica. Fructificationes non invenluntur in prima furcatione ramulorum. Oogonia solitaria vel frequenter geminata, ovoida. Oospora subglobosa subflavo maura cum 6 iugis non altis; 188 μ longa, 174-178.5 μ lata; membrana flavo-aurea, vermiformis granulata. Antheridia 158-162.5 μ in diametro.

Stem very slender, 235-305 μ in diameter, not incrusted; internodes 3-6.5 cm. long. Whorls of two kinds: those on the branches much congested and more or less moniliform. Both kinds of whorls are fertile. One or more frequently two branches develop at a stem node. Branchlets on the stem 6 at a node; 1-2 times furcate; primary rays about 2/5 the entire length of the branchlet; secondary rays 6, rarely 5; of the 6 secondary rays 3-4 divide again into 2-4 ultimate rays and the other 2 or 3 do not divide and are usually much longer than the dividing secondary rays, sometimes more or less equalling the combined length of the secondaries and their ultimate rays. Smaller whorls with very short branchlets forming dense heads; branchlets usually 6 at node, 2-3 times divided; entire length of branchlets 900-1650 μ. Primary rays about 1/3 the entire length of the branchlets, 300-600 μ long, 85-136 μ thick; secondary rays 4-5, 235-300 μ long, 45-70 μ thick; tertiary rays 3-4, 225-300 μ long, 52-75 μ thick; only one or rarely 2 of the tertiary rays divide into 2-4 ultimate rays (dactyls); sometimes the secondary rays do not divide at all. Dactyls 2-celled, rarely 3-celled, 47-84 μ thick; in the case of the smaller whorls 405-600 μ long; apex of the penultimate cell rounded; apical cells conical, 35-105 μ long, 18-28 μ broad at base.

Fructifications not found in the first furcation of the branchlets. Oogonia solitary or in many cases 2 together, ovoid in shape, 282-310 μ long (including

coronula), 221-258 μ broad, showing about 8-9 convolutions; in mature oogonia the convolutions are often displaced; coronula small, persistent, 24 μ high, 58.5 μ broad at base. Oospore subglobose, yellowish brown with 6 low ridges often ending in a short crown; in most cases the ridges are irregularly arranged; 188 μ long, 174-178.5 μ broad. Oospore membrane golden yellow brown, verniformly granunate. The membrane of a young oospore does not show any decoration. Antheridium158-162.5 μ in diameter.

Shallow ditch at Kahatu at the foot of the Murree Hills, *Dewan Mohindranath*, March, 1940.

It is a very slender plant and can be at once recognised by the branched nature and by the two kinds of whorls. The whorls of the branch appear more or less moniliform to the naked eye.

It is allied to *N. tenuissima* Kutz. and agrees with that species in having 6 branchlets at a node, the first branchlet-node sterile, but can at once be distinguished from that species by its regularly branched nature, the whorls of two different kinds, the branchlets less frequently forked (especially in the case of the stem whorls), the smaller number of secondary (in the case of the whorls of the branches) and tertiary rays, the occasional presence of 3-celled dactyls, oogonia being geminate in many cases, only 6 ridges in the oospore and by the entirely different decoration of the oospore membrane.

Distinguished from *N. habrocoma* Groves and Stevens in having the following characters:—(i) shorter primary rays, (ii) smaller number of secondary and tertiary rays (iii) not having a central ray, (iv) in *N. habrocoma* the lower cell of the dactyls somewhat narrowed at the apex where they are not broader than the base of the conical upper cells; in *N. pseudotenuissima* the lower cells are not narrowed towards the apex, apex rounded and broader than the base of the conical upper cells; (v) the decoration of the oospore membrane.

It differs from *N. batrachosperma* Braun in having less numerous branchlets in a whorl, the first branchlet-node sterile, the low ridges of the oospore and by the different decoration of the oospore membrane.

From *N. mucronata* Miq. and *N. gracilis* Agardh, and their various varieties it is distinguished by the first furcation of the branchlets sterile, smaller oospore and the decoration of the oospore membrane and also by the general habit of the plant.

Nitella bengalensis sp. nov.

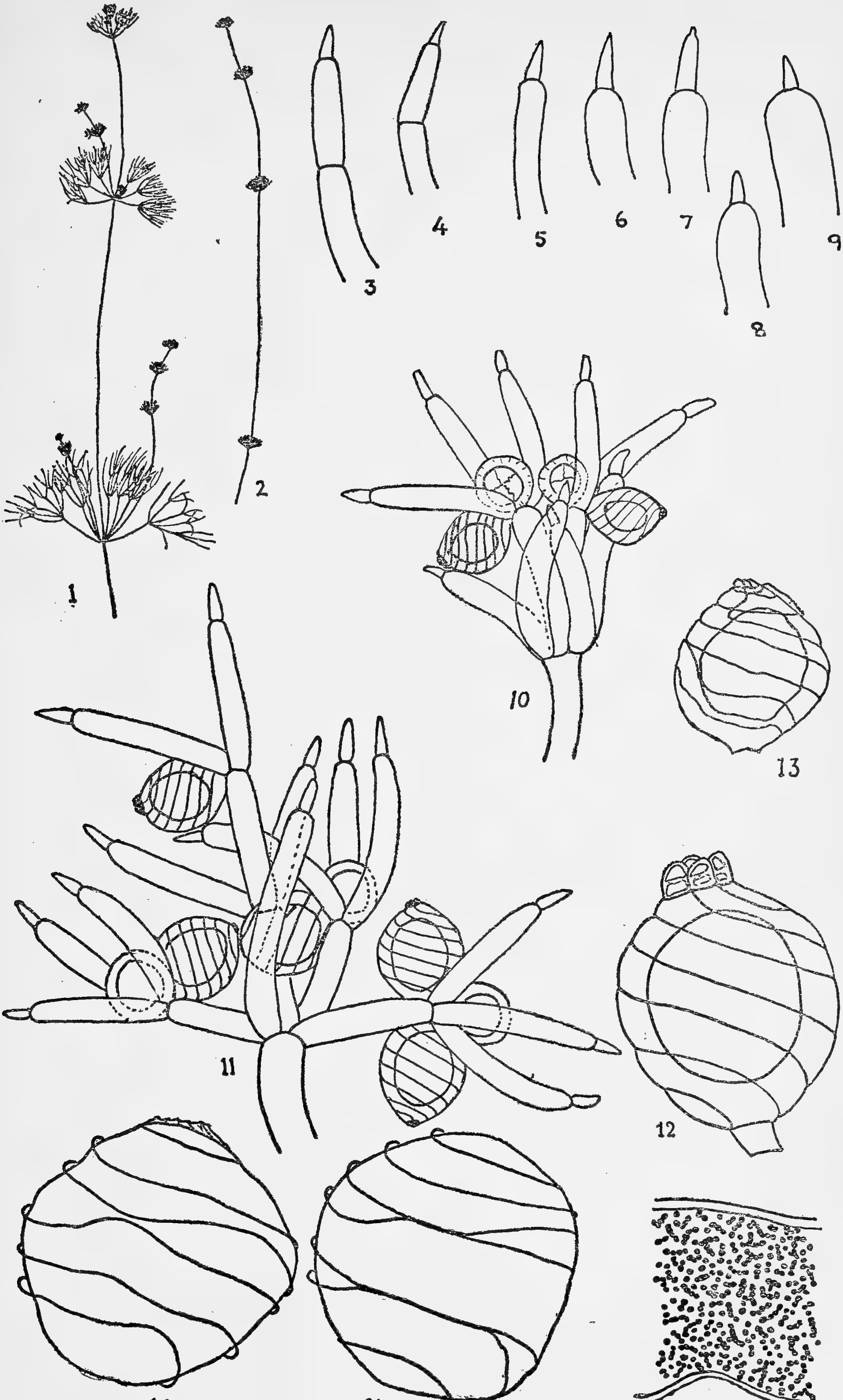
Arthrodactyla homoeoclema conoteles subflabellata gymnocephala macrodactyla monoecia.

Caulis 360 μ in diametro, verticilli 6 ramulorum, sterilis et fertiles dissimilares. Verticilli steriles—ramuli bis vel ter divisi, primarii radii circiter $\frac{1}{3}$ longitudinis totius ramuli, secundarii radii 4-6, tertiarii radii 2-4; quando 2 unus non dividitur et quando 3-4 duo non dividuntur; quaternarii radii 2-3. Verticilli fertilis densi et congesti, ramulorum 6 inequales, bis vel ter divisi; primarii radii circiter $\frac{1}{3}$ longitudinis totius ramuli; secundarii radii generatim 4-5, inequales cum unus centralis, tertiarii radii 2-4, 1-2 dividuntur in 2-3 ultimos radios; aliquotis omnes tertiarii radii non dividuntur. Dactylus 2-celluloris, cellula penultima attenuata ad finem distalem, cellula ultima conica, acuta vel parve acuminata.

Fructifitiones generatim in secunda et tertia furcatione ramulorum, aliquoties in prima. Oogonia solitaria generatim cum una antheridia, 432-450 μ longa (incl. coronula), coronula persistens, aliquoties decidua, cellula superiora aliquantulum elongata. Oospora subglobosa, parums subflavo-maura cum 6 iugis, 240-270 μ longa, 210-240 μ lata; membrana tenuis, tranlucens, exquisito reticulata, 11-12 spatia in fossula. Antheridium 225 μ in diametro.

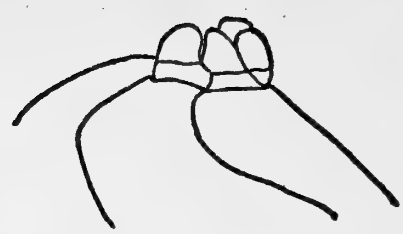
Plants monoecious. Stem 360 μ in diameter. Whorls of 6 branchlets, sterile and fertile whorls dissimilar. Sterile whorls—branchlets 4.5-7 mm. long; 2-3 times divided; primary ray about 1/3 to 2/5 of the entire length of the branchlets, secondary rays 4-6, nearly equal in each branchlets, varying in length in different branchlets; tertiary rays 2-4, one where there are only 2, or 2 where there are 3-4 tertiary rays do not divide; quaternary rays 2-3, nearly as long as or longer than the penultimate rays, rarely shorter.

Fertile whorls overlapping, congested; branchlets 6, unequal, 1800-4500, μ long, 2-3 times divided; primary rays about 1/3 to 3/5 of the entire length of the branchlets, 450-1800 μ long; secondary rays usually 4-5, rarely 3, very unequal in length, one being central, 405-945 μ long; tertiary rays 2-4, 495-675 μ in length;



B. C. Kundu.—TWO NEW NITELLAS.

For explanation see end of article.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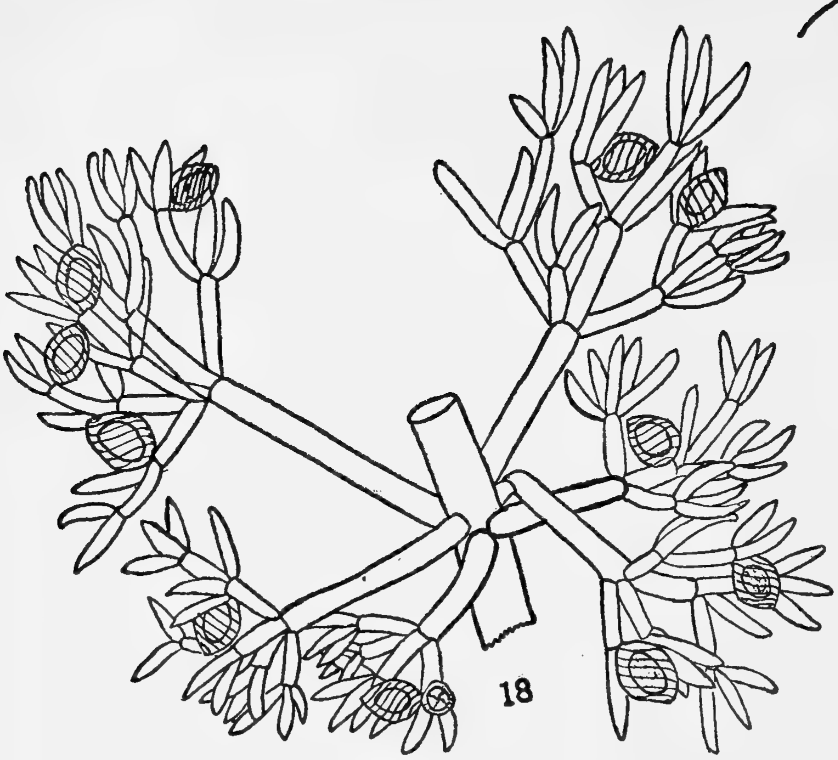
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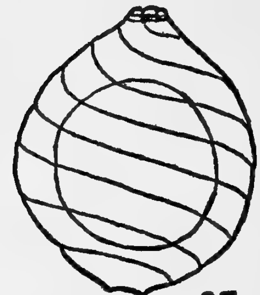
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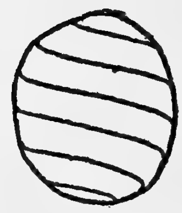
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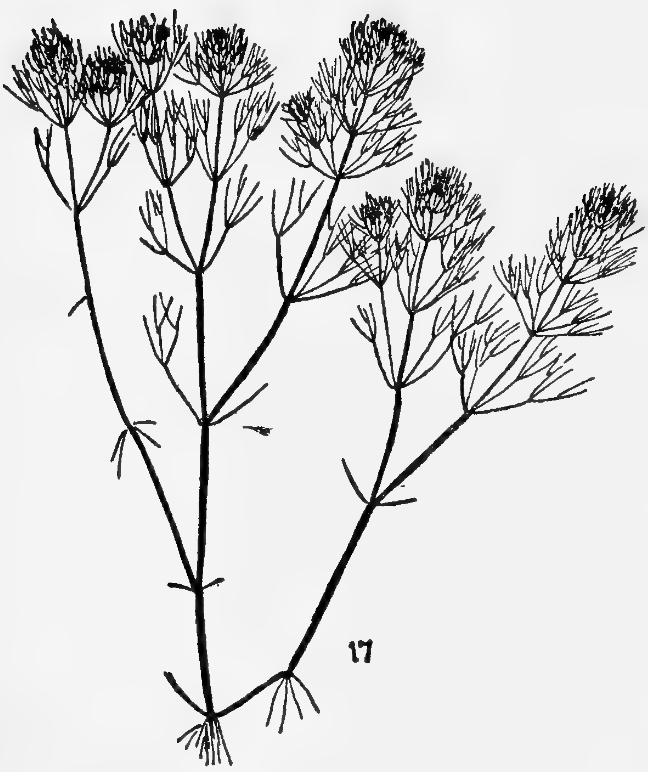
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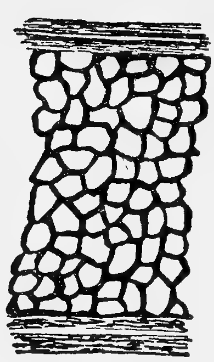
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B. C. Kundu.—TWO NEW NITELLAS.

For explanation see end of article.

1 or 2 of the tertiary rays usually divide again into 2-4 ultimate rays; in some cases all the tertiary rays do not divide again. Dactyls always 2-celled, 2025-2475 μ long, 90-112.5 μ thick, penultimate cell slightly tapering at the distal end; ultimate cell narrow, conical, acute or slightly acuminate, 58.5-126 μ long, 31.5-40.5 μ broad at base.

Fructifications usually at the second and third furcations of the branchlets, sometimes also in the first. Oogonia solitary, usually along with an antheridium at the second and third furcations of the branchlets, but without an antheridium when in the first furcation of the branchlets, 432-450 μ long (including coronula), 315-350 μ broad; spiral cells showing about 7-9 convolutions; coronula persistent, occasionally deciduous, 31.5-36 μ high, 51 μ broad at base, upper cells somewhat elongated. Oospore subglobose, 240-270 μ long, 210-240 μ broad, light yellowish brown, showing 6 slightly flanged ridges; membrane thin, translucent, finely reticulate, 11-12 meshes across the fossulae. Antheridium 225 μ in diameter.

Dhapdhapi, about 20 miles south of Calcutta, 30-1-40.

The plant was collected from a shallow ditch near Dhapdhapi Railway Station, which was fast drying up. The entire area round about the small ditch was covered with water during the rains and formed part of a shallow lake 'the Kalidaha'. At the time the specimen was collected a large part of the lake had already dried up excepting small ditches formed here and there, the places being slightly deeper than the surrounding area. The plants were growing under 6 inches of clear water in the middle of one of such ditches.

It is a rather slender plant, not more than 8-10 cm. in height and is somewhat tufted in habit. It is covered with annular incrustations or in some cases incrusted all over its body.

Its nearest relation seems to be *N. mucronata* Miq. from which it is separated by the following characters:—(i) dactyls uniformly 2-celled, (ii) shape of the apex of the lower cell and of the end cell, (iii) short internodes, (iv) first furcation of the branchlets frequently sterile, (v) branchlets being unequal in the fertile whorls, (vi) presence of a central ray, (vii) small oospore with low ridges, (viii) colour of the oospore.

From *N. gracilis* Agardh it is distinguished by the above characters and also by the character of the oospore membrane.

It resembles *N. tenuissima* Kutz. in having 6 branchlets at a node and the first branchlet-node being frequently sterile, but differs from that species in its entirely different general habit and having internodes shorter than branchlets, overlapping and congested fertile whorls, the branchlets of the fertile whorls being unequal in length, smaller number or ridges in the oospore and the nature of the reticulation of the oospore membrane.

Summary.

Two new Nitellas *N. pseudotenuissima* Kundu and *N. bengalensis* Kundu are described. *N. pseudotenuissima* has the general habit of *N. tenuissima* Kutz., but is sharply distinguished from the latter by its regularly branched nature, the whorls of two different kinds, the branchlets less frequently forked especially in the case of the stem whorls, the oogonia being sometimes geminate, less number of ridges in the oospore which are often irregularly arranged and by the entirely different decoration of the oospore membrane. By the above characters it is dstinguished from all other Nitellas. *N. bengalensis* Kundu is characterised by short internodes, overlapping and congested fertile whorls, the branchlets of the fertile whorls being unequal in length, dactyls uniformly 2-celled, fructifications mostly at the second and third furcation of the branchlets, oospore showing only 6 ridges and the oospore membrane being finely reticulate, having 11-12 meshes across the fossulae.

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Explanation of plates

Plate I.

Figs. 1-16.—*N. pseudotenuissima* Kund.
Fig. 1.—Part of a plant with branches (nat. size).
Fig. 2.—A well developed branch with small congested whorls (nat. size).
Figs. 3-9.—Ends of dactyls. × 65.
Figs. 10-11.—2 branchlets from a branch with fruiting organs. × 65.
Fig. 12.—A young oogonium. × 188.
Fig. 13.—A mature oogonium showing displacement of the convolusions. × 65.
Figs. 14-15.—Oospores. × 188.
Fig. 16.—Part of oospore membrane showing decoration. × 575.
Figs. 17-30.—*N. bengalensis* Kund.

Plate II.

Fig. 17.—A plant. × 11/16.
Fig. 18.—A fruiting whorl showing unequal branchlets. In this fructifications are not found in the first furcation of the branchlets.
Figs. 19-25.—Ends of dactyls. × 62.
Fig. 26.—Part of a young fruiting whorl with antheridium and oogonium. × 22.
Fig. 27.—A mature oogonium. × 45.
Fig. 28.—Top of an oogonium showing the coronula. × 179.
Fig. 29.—An oospore. × 41.
Fig. 30.—Part of oospore membrane showing decoration. × 550.

OBSERVATIONS ON THE BIOLOGY OF SOME SOUTH INDIAN COCCIDS.

BY

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(*With 4 plates*).

The insect group Coccidae constitutes one of the largest and most important families of Homopterous bugs, and from the economic point of view this family is one of the most important groups of insects which man has to deal with.

With the idea of supplementing our knowledge of the species of this group found in South India, an attempt is made in this paper to give descriptive accounts and life-histories of three species, one of which is recorded for the first time from India. The results of the studies embodied in this paper are based mainly on the material collected by the writer during his stay as a research student in the laboratory of the Government Entomologist, Agricultural College, Coimbatore, during the year 1934.

Pulvinaria durantae, var. nov?

(Plate I; figures 1 to 11).

Ayyar (1936) recorded this new variety for the first time from India on the roots of cultivated *Amaranthus* plants in and around the Agricultural College Estate, Coimbatore.

On plants which are badly infested with this scale, almost all the different stages of the insect can be found at any time. The attacked plants have a sickly appearance, with the foliage faded and drying up. In fact these insects were revealed when such withered plants were pulled out.

Adult female: The mature female measures 2.86 mm. in length (average of 6 adults) and 2.4 mm. in breadth at the broadest region, which is very near the posterior extremity. The anterior portion is slightly pointed. The general shape is ovoid with the dorsum highly convex. In older specimens the posterior region is flattened. The body is covered all over with long curved spines which are longer and more numerous towards the posterior end. The anal cleft extends to about one-fifth the length of the body. The limbs and antennae are well-developed. The anal operculum is quite prominent and darker in colour than the rest of the body. The general colour of the insect is dark brown, more or less obscured by a white powdery secretion. The stigmatic clefts are shallow, transverse grooves and are not very clearly demarked in life.

The development of ovisac and oviposition are in *P. maxima* Gr., (Ayyar, 1925). The sac attains a maximum length of 8 to 10 mm. There is a median longitudinal groove along the ovisac with two lateral ones on either side.

The Formosan species, *P. durantae* to which this species is allied, is described by Takahashi (1931) as below:—

'Adult female: Very closely related to *P. psidii* Mask., but differs from it in the following characters.

1. Marginal setae simple, not dilated nor furcated apically, nearly half the length of the longest stigmatic spine but longer than the shorter one; about 0.0277 mm. in length.

2. Legs shorter; hind femur about 0.18 mm.; hind tibia about 0.16 mm.; hind tarsus about 0.097 mm. in length.

3. The three setae arranged in a row near the base of each antenna, a little smaller.

The body of the adult female is about 3 to 4 mm. in length and is provided with many circular or sub-circular small pores over the dorsum and the abdominal and thoracic segments are defined on dorsum.'

The adult female when mounted, is broadly ovate, with the anterior end pointed. The antenna is well-developed, eight-segmented. In some specimens the third segment shows a division, making the antenna nine-jointed.

The lengths of the various antennal segments of six specimens are as follows. The right antenna is taken into consideration and measurements are given in microns.

Specimens	Segments							
	1	2	3	4	5	6	7	8
I	15	17	20	13	14	8	7	10
II	16	17	21	12	15	9	8	12
III	15	16	19	11	14	7	6	11
IV	13	18	20	11	13	9	7	12
V	12	15	19	11	14	7	6	Broken
VI	14	15	20	11	14	8	7	11

The average length of antenna is 0.44 mm. The antennal formula is 3. 2, 1, 5, 4, 8, 6, 7. The third segment is the longest and the second is the stoutest and next to the third in length. The terminal segment carries four to five hairs. The stigmatic cleft is shallow and in older specimens not demarked. There are three stout spines marking the stigmal region, central one twice as long as the lateral. The spiracular opening is wide and conspicuous. There is a series of pores leading from the margin up to the stigmata. The margin of the body is fringed with slender spines. In this variety the spines are of two kinds. There are the usual spiny curved hairs intermingled with stout, dilated and furcated hairs as in *P. psidii* Mask.

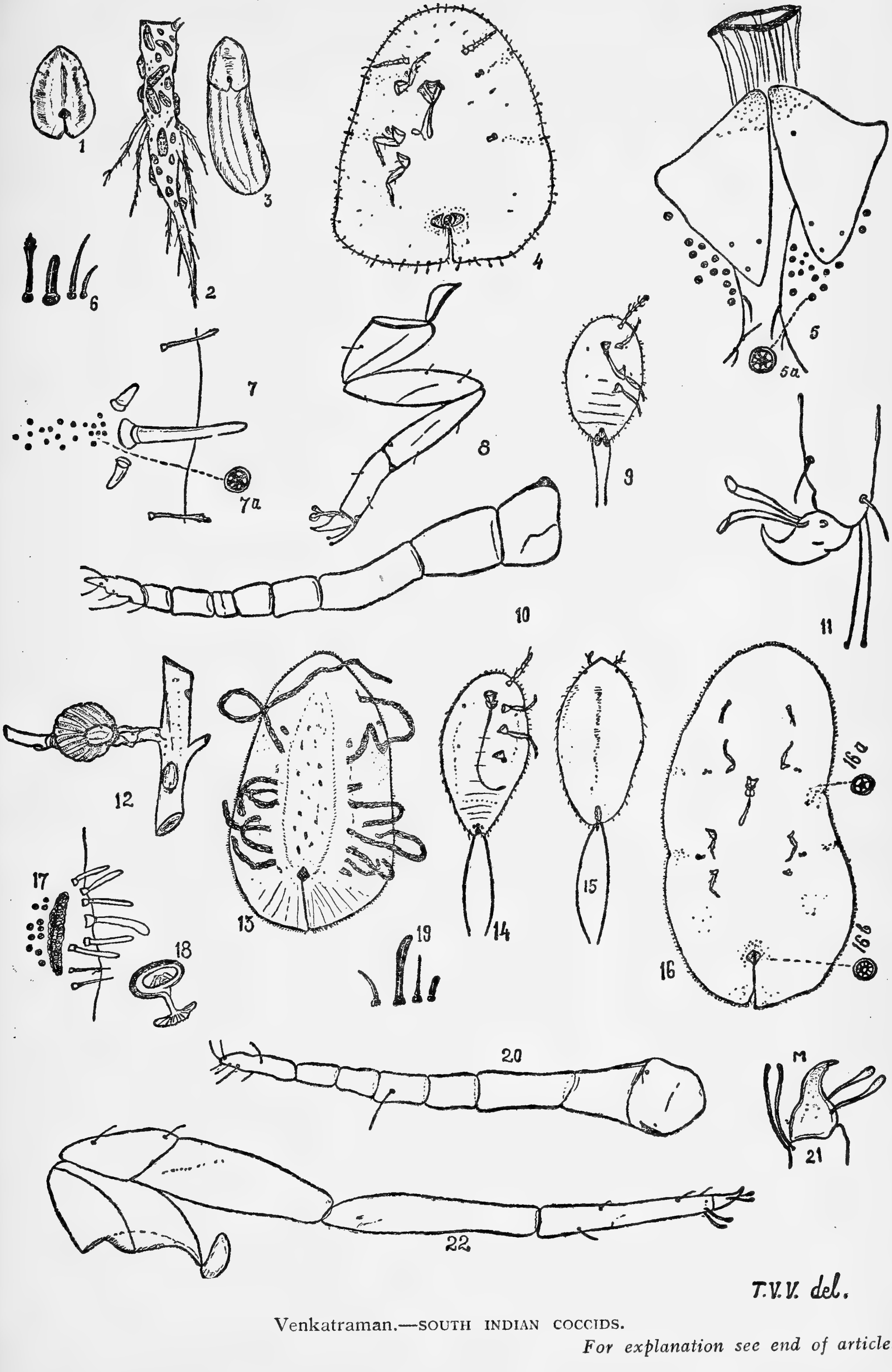
The leg is well-developed. The femur is longer than tibia; tarsus more than half the length of tibia. The claw is well-developed and curved. The tarsal digitules are short, stout and dilated distally. The unguals arise from the sides of the claw. The anal cleft extends to about one-fifth the length of the insect. The anal plates are more or less triangular, the inner side the longest. The outer angle carries a very long seta. On the distal end also there are smaller hairs. The anal region is provided with numerous multilocular pores.

Remarks.—This form appears to be a variety of *P. durantae* Tak., the adult female agreeing with it in possessing smaller legs and shorter setae arranged near the antennae, but differing in that some of the marginal hairs are dilated and furcated apically as in *P. psidii* Mask. This form is intermediate between *P. psidii* Mask., and *P. durantae* Tak. In external appearance and production of ovisac it resembles very much *P. psidii* Mask.

Ceronema koebelei Green.

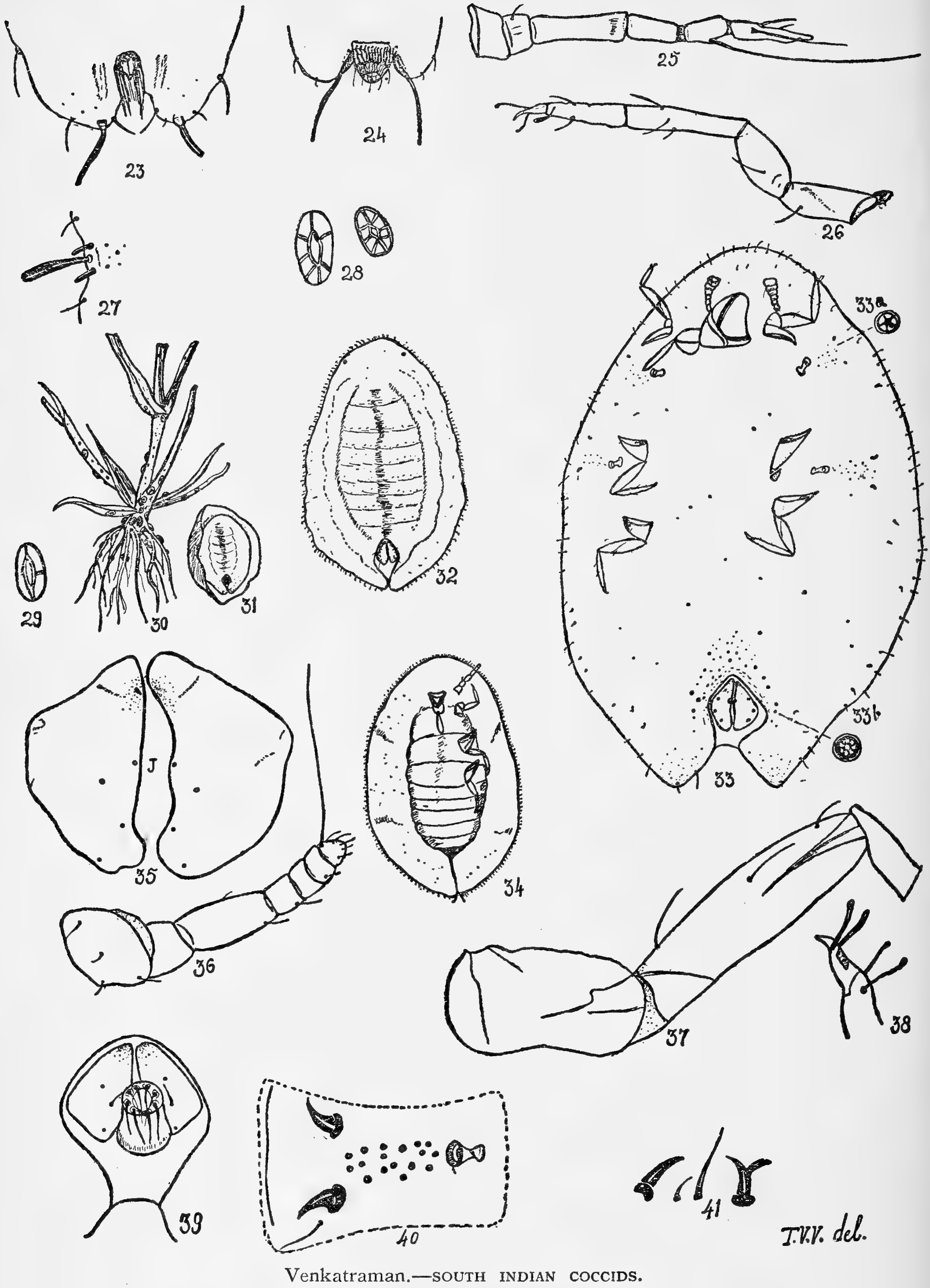
(Plates I, II; figures 12 to 28.)

This coccid was found by the writer on the branches and stems of *Caesalpinia coriaria*, a familiar tree around the Agricultural Farm, Coimbatore, during January 1934. Ayyar (1936) recorded this insect for the first time from India. It was originally described by Green (1909) from Kandy, Ceylon, on branches of



Venkatraman.—SOUTH INDIAN COCCIDS.

For explanation see end of article.



Venkatraman.—SOUTH INDIAN COCCIDS.

For explanation see end of article.

Sapium sebiferum collected by Alber Koebele after whom it is named. According to Green it has never been noted as a pest in Ceylon. Rutherford (1915) has recorded it from Ceylon on the twigs of *Pithecolobium saman.*

Description, life-history and habits. The adult females were noted on the older branches of the tree and the freshly hatched nymphs were seen migrating slowly to the tender shoots.

The mature female insect measures from 7.5 mm. to 8.2 mm. in length and 6 mm. to 7.25 mm. in breadth. The broadest region is just behind the middle. The general shape is elongate oval, convex above, with an inconspicuous carina on the dorsum. The general colour is greenish brown. The ventral surface is slightly lighter in colour. The eyes and the anal operculum are chocolate brown in colour. The mid-dorsal area is covered with a fine coating of mealy material. The anal cleft extends to about one-sixth the length of the whole body. The anal valves are small.

The ovisac is made up of a felted buff-white secretion, secreted by special glands found on the dorsum of the insect. The ovisac is formed by the fusion of seven to eight pairs of coiled-up creamy white processes arising from either side of the dorsum. These processes spread outwards coiling and fixing themselves on the host plant. The fusion of these processes are clearly indicated on the ovisac by prominent ridges. Due to the formation of the ovisac the adult is carried up and assumes a tilted position as in the genus *Pulvinaria.* In the early adult female a crenulate line of white secretion along the sides marks the formation of the future ovisac. The margin of the body is fringed all round with stout pointed spines. The female insect, after maceration in potash agrees with Green's description. The following remarks may, however, be added to his description.

The body is broadly ovate. The derm is covered irregularly with more or less polygonal cells. The spinning glands corresponding to the ridges of the ovisac are placed round the margin of the body just dorsal to marginal spines. Anal lobes are furnished with a variable number of spinose hairs and the anal operculum is provided with eight to ten long hairs. The margin of the body is provided with a close series of pointed spines. The stigmatic clefts are furnished with ten to eleven spines each, including a large central spine and the cleft is bordered by a lunate chitinous plate. The antenna is eight-jointed; third and fourth joints apparently without any hairs and sixth with a very long hair. Legs are well-developed; foot with four digitules, dilated distally. Claw is bent strongly at the tip, and provided with a minute denticle on the inner side near the extremity.

The adult females with their eggs are found grouped together on the same branch. The ovisac under normal conditions, is fairly big and handsome. The interior of the ovisac is smooth. Each ovisac encloses numerous eggs, all beautifully and closely packed together. The number of eggs in a single ovisac was found to be 640. The eggs are greenish in colour, smooth, elongate and measures about 0.28 mm. in length. The eggs in each mass do not hatch all at the same moment, but it takes three to four days for all the nymphs in one mass to hatch out. The nymphs break through the walls of the ovisac and emerge through small slits made on the ovisac.

The early larval stages. The just hatched larva, which is a fairly active creature, is elliptical and reddish in colour. It bears a pair of caudal setae as long as the body. The margin of the body is fringed with fine curved hairs. The antennae and legs are well-developed. The antenna consists of six segments the third segment is longest and the fifth carries a very long seta. The fifth and terminal segments show traces of segmentation. The anogenital ring is provided with six stout hairs. Length 0.72 mm., breadth 0.6 mm.

The just hatched larva after moving about for some time near to its birth place, migrates slowly to a favourable spot and settles down to feed. The nymphs are restless only for five or six days after which they permanently settle down on the food plant. The nymphs are very slow in developing. They moult thrice before they attain the adult stage. In the process of moulting the whole outer covering is involved including the rostral apparatus and anal plates.

Although the male puparia were found in large numbers adult males could not be noticed.

The female insect is clearly marked out in the second stage; the insect grows broader and the waxy spots appear on the dorsum. The life-cycle is found to occupy 95 to 100 days.

Natural enemies.—A few adult coccinellids, *Scymnus coccivora* Ramakrishna, were found feeding inside the eggsacs.

Lecanopsis ceylonica Green.

(Plates II and III; figures 29 to 53.)

These insects were collected by the writer on the roots of grass in Coimbatore during April 1934. They were mostly found on the roots of grass covered by stones or pebbles. Green (1922) first described the species collected from Ceylon, 'at the base of a grass plant, below a large stone'. It is clear that these insects require a cool and shady place to thrive well. This is the first record of this insect from India.

The nature of the damage done by the insect.—A number of adult females with conspicuous eggsacs were revealed on removing a few stones, mostly attached to the lower sheathing base of the stem and roots of the grass. They were noted in all stages and generally the mature females selected the broad blades of the grass for oviposition. The attack spreads rapidly all over the place and the plants dry up. The young nymphs are very active, crawling over long distances in search of a suitable place. A species of black ant visits them in large numbers to feed on the honeydew secreted by the maturing female. The ants sometimes go under the soil in search of the sweet sugary fluid.

Description, life-history and habits.—On grasses which are pretty badly infested with the scale, almost all the different stages can be noted at any time.

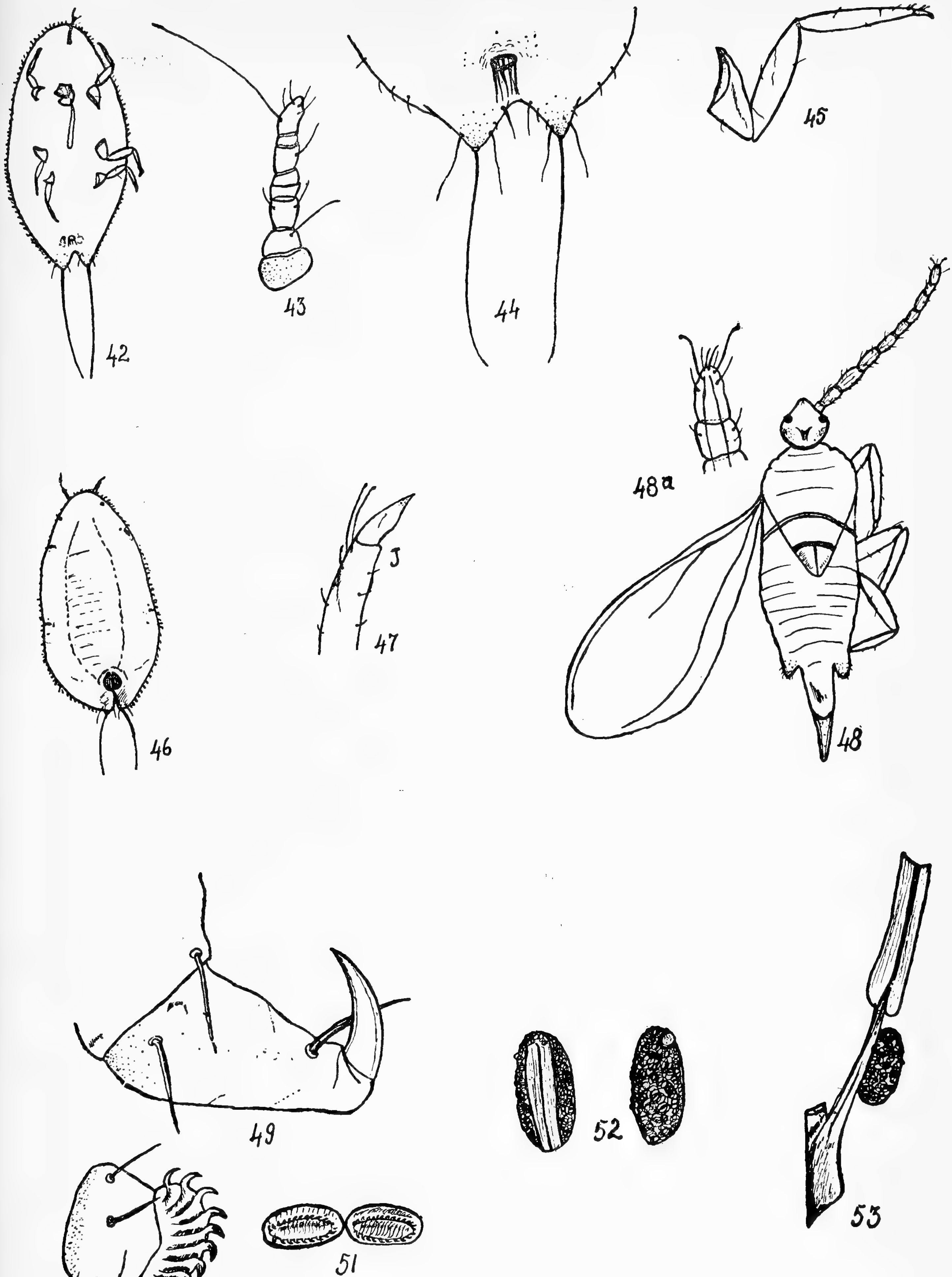
The mature female, just before it develops the ovisac measures from 3.0 to 3.5 mm. in length and 1.5 to 1.7 mm. in breadth; more or less ovate, broadest portion near the posterior end. The derm is highly convex and the insect is partially surrounded by a white felted test.

Specimens collected by the writer are larger than the Ceylonese form and are very closely pitted on the dorsum.

The antenna is six-segmented, without any trace of further segmentation. The 6th segment carries a very long lateral seta which is longer than the antenna itself. Antennal formula may be noted down as *3, 2, 1, 6, (5, 4)*. Measurements of the right antennal segments of 6 adults are as below: (Measurements in microns).

Adults	Segments					
	I	II	III	IV	V	VI
1	8	9	20	5	6	7
2	8	10	21	5	5	6
3	7	9	20	5	6	7
4	7	10	19	5	5	6
5	8	11	22	6	6	8
6	6	9	21	6	6	8

Legs well developed, 2.7 mm. in length with the tibiotarsal articulation subobsolete. Tarsus is about half the length of tibia. Tarsal digitules slender, long and knobbed. The ungual digitules are dilated. Anal plates surrounded



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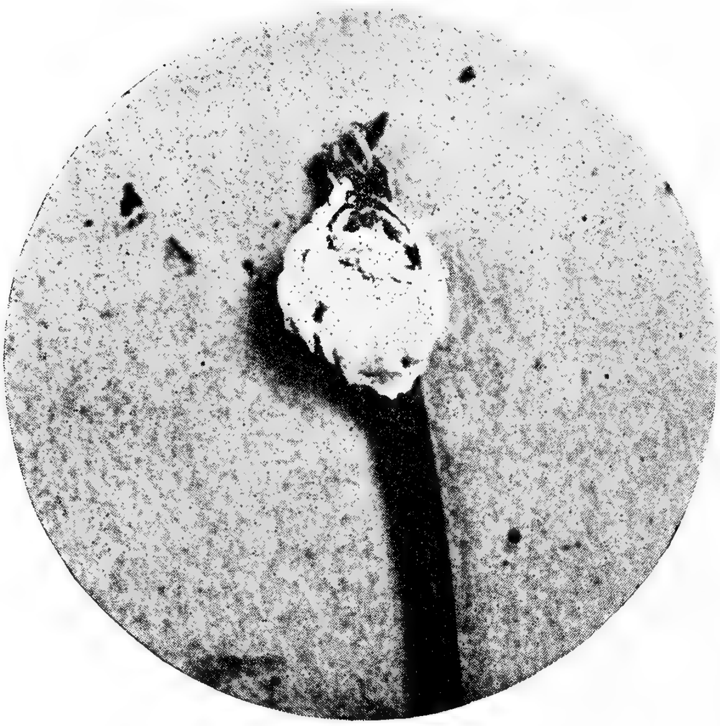
Venkatraman.—SOUTH INDIAN COCCIDS.

For explanation see end of article.



Adult female of *Ceronema koebelei* gr. with egg-sac *in situ.* (nat. size).

by a narrow, densely chitinised area, the base about equal to outer margin; outer angle rounded; three dorsal and one sub-apical spines; stigmatic spines two, of equal length, stout, curved, pointed and wide apart; the distance is at least equal to thrice the length of the spine. Dorsum rather densely chitinised, thickly set on the margin with small circular openings leading to tubular ducts. Margin with long setae. There is also another shorter series slightly more internal. Some of the spines of this series are branched. This species is closely related to *Loemica ghesquierei* L., a subterranean form found on the roots of grass in Belgian Congo (Laing, 1929).

The early larval stages.—The newly hatched larva is a very active creature, crawling up the blades of the grass. It is about 1.0 to 1.2 mm. in length; 0.5 to 0.7 mm. in breadth, with fairly well-developed limbs and antennae. The general colour is yellowish, with brownish eyes. Antenna of larva apparently 6-segmented, but the 4th and 5th segments show clear traces of division, thus making the antenna 8-segmented instead of 6. The terminal segment carries nine hairs including one long lateral hair, which is longer than the antenna itself. Legs robust; tibia and tarsus approximately of equal length and the articulation is distinct. Claws slender and strongly curved. Stigmal spines as in the adult. The anal lobes are prominent, with 3 to 4 long setae. The anal ring is provided with 6 long hairs.

The male insect.—The male puparia have the usual glassy test with longitudinal and transverse ridges on the surface. It is about 2.0 mm. in length and 0.8 mm. in breadth. It is more or less elongate and made up of a shining secretion of wax. The adult emerges in about 10 days after pupation. The waxy caudal filaments are seen protruding from the posterior end of the puparium just before emergence.

Males are comparatively fewer than females and the emergence of males takes place mostly in the afternoon. Soon after emergence they remain stationary for some time, drying their wings and body. Then they try to move about slowly and in about ¾ to 1 hour they begin to react to the presence of females, by raising the tips of their abdomen. The male wanders about climbing up various females, and finally selects a fairly mature one for copulation. It clings on to the posterior end of the female and slowly introduces the genital sheath into the aperture of the female. Copulation lasts for two to three minutes. In the course of about an hour, a single male was observed to copulate with 5 females.

The adult male is a delicate active creature, yellowish-red in colour and with transparent wings. It is about 1.8 mm. long. Ocelli black. Antennae and legs long and slender. The antenna consists of 10 segments, the terminal segment carrying a few curved hairs. Wings fairly large, about 1.2 mm. in length, clear, with very few lines. The genital sheath is long, curved and with a pointed tip (about 0.34 mm. in length). There is a pair of long waxy filaments, rising from the caudal end of the abdomen. The caudal end bears two rounded prominences on either side, carrying a number of spines.

Natural enemies.—This scale is subject to the attack of a very interesting Epipyropid caterpillar which feeds on the eggs and young nymphs of the insect. The caterpillars were found under the soil feeding voraciously on the eggmasses. In the Insectary, a single caterpillar, in the course of week, devoured about 18 fully matured eggsacs and a few young nymphs. The young larva is pale white in colour and hardly distinguishable from the bases of the grass.

Fully developed caterpillars are 15-18 mm. in length. General colour is brownish. The anterior end is tapering and the posterior bulging out. The stoutest portion is about 5 to 8 mm. broad. The dorsum is covered with numerous, regularly arranged, long hairs. Each segment bears about 8 to 10 hairs. Head chocolate coloured, with well-developed dark mandibles. The prolegs are flattened and fringed with a complete circle of crochets. The true legs are well-developed, with robust, recurved claws. The curved claws help the larva in crawling through the soil.

The caterpillars pupate under the soil, often attached to the leaf-sheath of the plant. The cocoon is made up of tough silk, mud particles and remnants of eggsacs of the scale devoured by the caterpillar. The cocoon is oval, about 12 to 13 mm. long. The adult moth emerges through a circular hole near the anterior extremity of the cocoon. The adult moth is bright rufous; head brownish; thorax with scales tipped with grey. Fore wing with small spots. Expanse 40 mm.

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Explanation of Plate I.

Pulvinaria durantae var. nov?

Fig. 1.—Adult female before gestation, dorsal view, ×8.
Fig. 2.—Insects on *Amaranthus* roots, (2/3 nat. size.)
Fig. 3.—Adult female with eggsac, ×6.
Fig. 4.—Adult female before gestation, after maceration in potash, ventral view, ×18.
Fig. 5.—Anal operculum and pores, adult female, ×180.
Fig. 5*a*.—Multilocular pore in the anal region, female, ×400.
Fig. 6.—Different kinds of setae, adult female, ×180.
Fig. 7.—Stigmatic region with spines, adult female, ×180.
Fig. 7*a*.—Quinquelocular pores in the stigmal area, female ×400.
Fig. 8.—Mid leg, adult female, ×36.
Fig. 9.—Just hatched larva, ×18.
Fig. 10.—Right antenna, adult female, ×180.
Fig. 11.—Tarsus of midleg and claw, adult female, ×400.

Ceronema koebelei Green.

Fig. 12.—Adult female with eggsac, in situa (2/3 nat. size).
Fig. 13.—Adult female, beginning to oviposit, ×8.
Fig. 14.—Larva, 15 days old, ventral view, ×18.
Fig. 15.—Larva, 15 days old, dorsal view, ×18.
Fig. 16.—Adult female, after maceration in potash, ×8.
Fig. 16*a*.—Quinquelocular pore from stigmal region, ×400.
Fig. 16*b*.—Multilocular pore from anal region, ×400.
Fig. 17.—Stigmatic area and spines, adult female, ×180.
Fig. 18.—Anterior spiracle, ×400.
Fig. 19.—Different kinds of setae from adult female, ×400.
Fig. 20.—Antenna, adult female, ×180.
Fig. 21.—Foot of mid leg, adult female, ×400.
Fig. 22.—Mid leg, adult female, ×180.

Explanation of Plate II.

Ceronema koebelei Green. (Contd.).

Fig. 23.—Posterior Extremity, larva, (15 days old) ventral view, ×180.
Fig. 24.—Posterior extremity, larva, (15 days old) dorsal view, ×180.
Fig. 25.—Right antenna, larva, ×180.
Fig. 26.—Mid leg, larva, ×180.
Fig. 27.—Stigmatic region, larva, ×180.
Fig. 28.—Male puparium (enlarged).

Lecanopsis ceylonica Green.

Fig. 29.—Test of male (enlarged).
Fig. 30.—Insects on grass (sligthly reduced).
Fig. 31.—Adult female, dorsal view, (enlarged).
Fig. 32.—Adult female, before oviposition, dorsal view, ((enlarged).
Fig. 33.—Adult female after maceration in potash, ventral view, ×400.
Fig. 33*a*.—Quinquelocular pore from stigmatic area, adult female, ×400.
Fig. 33*b*.—Multilocular pore from anal region, adult female, ×400.
Fig. 34.—Adult female, before oviposition, ventral view, (enlarged).
Fig. 35.—Anal valves, female, ×180.
Fig. 36.—Antenna, female, ×180.
Fig. 37.—Mid leg, adult female, ×180.
Fig. 38.—Tarsal claw, adult female, ×180.
Fig. 39.—Posterior extremity, female, ×180.
Fig. 40.—Anterior spiracle and stigmal spines, adult female, ×180.
Fig. 41.—Different kinds of setae, adult female, ×180.

Explanation of Plate III.

Lecanopsis ceyloniea Green. (Contd).

Fig. 42.—First stage larva, after maceration, ventral view, ×28.
Fig. 43.—Antenna, first stage larva, ×180.
Fig. 44.—Abdominal extremity, first stage lava, ×180.
Fig. 45.—Leg, first stage larva, ×180.
Fig. 46.—Female nymph, 2nd stage, (enlarged).
Fig. 47.—Foot of adult male, ×400.
Fig. 48.—Adult male, ×180.
Fig. 48*a*.—Terminal segments, antenna, adult female, ×400.
Fig. 49.—Leg of predatory caterpillar on *L. ceylonica* Gr., showing the curved claw. (highly magnified).
Fig. 50.—Anterior pro-leg of caterpillar (enlarged).
Fig. 51.—Anal pro-leg of caterpillar (enlarged).
Fig. 52.—Cocoon of caterpillar, ×2.
Fig. 53.—Cocoon of caterpillar on grass, (2/3 nat. size).

Explanation of Plate IV.

Fig. 54.—Adult female of *Ceronema koebelei* Gr., with eggsac, *in situ.* (nat. size).

INSECTICIDAL AND PISCICIDAL PLANTS OF INDIA

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The discovery and application of cheap insecticides for the diverse needs of agriculture, destruction of household pests, and preventing of vectors of malaria and similar insect-borne diseases play a very important part in the economy of nations at the present day. At a moderate estimate the total annual loss to India through insect pests has been computed at roughly 2,000 millions of rupees and over a million and a half of human lives. Added to this is the fact that, in spite of all efforts to the contrary, advances in civilization are producing conditions specially suited for insect multiplication in most areas.

Most of the insecticides used in India at present are very expensive as they have to be imported from foreign countries. Further, owing to shipping difficulties and the rise in prices due to war conditions, the situation has become so acute that even ordinary well-to-do people are unable to afford these protective remedies against the ravages of insects. The great masses of India, whose economic condition is proverbially low, could ill-afford to use the costly imported commodities even before the outbreak of war while the present-day prices are entirely beyond their means. The ever-increasing demands of the large fighting forces has further made it imperative to fall back on the easily available indigenous supplies which may replace the imported materials. The Medicinal Plants and Food Poisons Inquiry has of late received many inquiries from various parts of India and overseas for information in regard to the medicinal and insecticidal plants of this country. Thanks to the foresight of the Imperial Council of Agricultural Research for financing this Inquiry six years ago, it is now possible to help with advice scientists, agriculturists, and commercial concerns interested in this field. Chopra and Badhwar (1) recently discussed the vast potential resources of the country in these directions and published a comprehensive survey of Indian plants poisonous to man, livestock, insects and fishes. Their studies revealed that a much larger number of potential insecticidal plants are available in India than in any other area of a similar size. In this paper we deal with the distribution, chemistry, and

other details with regard to the Indian insecticidal and piscicidal plants.

Arsenicals, lead and silicofluoride insecticides, etc., are very efficacious but have the serious drawback of being injurious to human beings and other warm-blooded animals generally. It is for this reason that increasing attention is being directed nowadays to insecticides of vegetable origin which, besides being effective against insects, are less harmful to man and animals. A large number of plants have been the subject of investigation in different countries, and, in this field of research, workers have taken advantage of the fact that quite a number of plants which are employed by the local natives as fish poisons from time immemorial have also been found to possess insecticidal properties. It is for this reason that we deal with the commonly recognized Indian insecticidal and piscicidal plants in this article, so that workers may be able to select plants for investigation from as large a list of suitable material as is known at the present day. The most outstanding results of the investigation of native fish poisons have been the discovery of the important insecticidal properties of certain species of *Derris, Lonchocarpus,* and *Tephrosia*. It does not, however, follow that, because a particular plant possesses piscicidal properties, it is necessarily of equal value as an insecticide. Pyrethrum, for example, which yields pyrethrin as its active constituents, is one of the very potent and widely used insecticides at the present day, but its use as a local fish poison is not recorded anywhere.

Biological investigations are very essential to evaluate the effect of insecticides on various kinds of insects, before any plant can be pronounced as a suitable insecticide. No plant must without detailed experimental data be regarded as universal insecticide, for, several which cause cent per cent mortality in one species of insects, may be less efficacious or even useless for others. Attention has recently been drawn to the fact that the total toxic effect of a mixture of two different insecticides is greater than the sum total of the individual effects of the two component insecticides taken independently (**2**). This phenomenon is known as synergism, *i.e.*, working together or co-operating, and is important not only from the point of view of increasing the efficiency of known insecticides by making suitable combinations, but also for the utilization of many insecticidal plants of Indian origin that may not be quite up to the standard when used alone.

Important Vegetable Insecticides

Among vegetable insecticides of proven value may be mentioned some species of *Chrysanthemum* (pyrethrum), *Derris* (tuba root), *Lonchocarpus* (cube root), *Tephrosia*, *Nicotiana* (tobacco), *Picrasma* (quassia), *Delphinium* (larkspur), *Veratrum,* etc. Of these *Chrysanthemum cinerariifolium* Vis. and *Derris elliptica* (Roxb.) Benth. have acquired great importance as plant insecticides during the last 15 years.

On account of the proved effectiveness of the flower-heads of *Chrysanthemum cinerariifolium* in destroying insects and mosquito larvae, Japan, Kenya, Yugoslavia, Brazil and some other countries

have taken up extensive cultivation of this plant. According to Holman (**3**), the total world production of pyrethrum flowers at the present time is probably over 15,000 tons. Various types of powders, dusts and sprays, with pyrethrum as the main insecticidal constituent, are available in the market for horticultural, household, and veterinary use. Recently the control of insect pests, which damage stored products in warehouses, has been successfully attempted with the help of pyrethrum sprays. At least two efficient aqueous base pyrethrum insecticides are now available in the market for destroying insects and mosquitoes in the interiors of aircraft, thus preventing the transmission of diseases, such as yellow fever, where for obvious reasons it is imperative to use non-inflammable spray (**4**). A very important use to which pyrethrum is being put nowadays is as a mosquito larvicide in antimalarial measures. A large number of the known larvicides are unsuitable for this purpose as they are definitely injurious to the aquatic vegetation and fishes in the areas treated, but a pyrethrum larvicide prepared according to a formula developed by Guisbug (**5**) is stated to be free from these disadvantages, and still a very useful larvicide.

As suggested by Chopra and Badhwar (**6**), outer temperate Himalayas and hill stations in other parts of India are likely to prove suitable for the cultivation of pyrethrum in this country; and it may be noted that the plant, on the whole, has grown well at altitudes of 5,000 to 6,000 ft., but it is advisable to avoid areas of high rainfall. A series of samples analyzed at the Calcutta School of Tropical Medicine from plants grown in Kashmir and the Murree Hills were found to be of as good a quality as any produced elsewhere. Both the total pyrethrin content of the flower-heads and biological tests compare favourably with the imported stuff. Large areas in the North-West Himalayas, especially in Kashmir, are available where good quality of pyrethrum could be grown in practically unlimited quantities and where ideal conditions for successful cultivation prevail. Amongst the attempts so far made for the cultivation of pyrethrum in India may be mentioned those at Baramulla and Tangmarg in Kashmir, Murree Hills, Kulu Valley, Palampur and Kasauli in the Punjab, Parachinar in the Kurrum Agency, North-West Frontier Province, the United Provinces, Bengal, Madras, and Mysore State. Cultivation has so far failed at Ranchi, Poona, Kasauli, and in Sind. The failure of pyrethrum germination at Kasauli in the Punjab and at Ranchi must be regarded as accidental, and further attempts to grow it are likely to meet with success.

Derris elliptica is found in Burma, Siam, Cambodia, Cochin-China and Malaya, and also in the East Indian Archipelago and the Philippines. It is found in India only to a limited extent in Chittagong. Practically all the tuba root of commerce is produced in Malaya, Dutch East Indies, Philippine Islands and Sarawak, where large-scale cultivation of the plant is carried out. It has also been successfully cultivated experimentally in other tropical countries, such as parts of East and West Africa, the Congo and West Indies. Of the other species of *Derris* examined, only *D. malaccensis* Prain has assumed commercial value equal in importance to *D. elliptica,* and is being largely cultivated. Experi-

mental cultivation of *D. elliptica* and *D. malaccensis* has been attempted in Travancore, the Punjab, Kashmir, Mysore, and Dehra Dun; that grown in Mysore has been found to contain up to 7 per cent of rotenone in its roots, which is encouraging. Over 20 species of *Derris* are found in India, several of these growing abundantly. There is a great possibility that some of these at least may prove to be of important insecticidal value. Of the Indian species so far examined, only *D. ferruginea* (Roxb.) Benth. has been shown to contain rotenone, and may prove a good insecticide. A number of species of *Derris* are known to be used extensively in tropical countries for catching fish. The crushed portions of these plants thrown into streams and ponds stupefy fishes, and make them float up to the surface.

Of other plants containing rotenone and allied compounds, mention may be made of species of *Lonchocarpus, Tephrosia,* and *Mundulea,* which, like derris, are locally used as fish poisons. Some species of *Lonchocarpus,* such as the cube root (*L. utilis* A.C. Smith and *L. uruca* Philip and Smith) have assumed importance as insecticides equal to that of derris. Commercial supplies of both *L. utilis* and *L. uruca* at present are obtained only from Peru and Brazil, where their cultivation is being successfully carried out. No attempts so far have been made to cultivate any of the cube roots in India, but there seems little doubt that successful plantations could be raised in Bengal and the Madras Presidency. Some of the foreign species of *Tephrosia* have been shown to possess marked insecticidal properties, while others have been found to be of little or no value. *T. vogelii* Hook. *f.* has been shown in Africa to be an efficient insecticide for fleas, lice and ticks, and has been suggested as a cheap commercial dip for cattle. *T. vogelii* is largely cultivated in the tea gardens of Assam for use as a nitrogenous manure. Chopra and collaborators (7) have recently found that the leaves of the Assam-grown plants do not possess insecticidal properties to any marked degree. It is possible, however, that this conclusion may have to be modified when leaves plucked at various times of the year are examined. Its seeds, which are stated to be the most toxic part of the plant, have not been investigated so far. *Mundulea sericea* (Willd.) Greenway (*M. suberosa* Benth.) is extensively found in South India; some samples of its leaves, bark, seeds, and root have been shown to be fairly toxic to certain types of insects (3).

Tobacco and its preparations in the form of sprays, dusts and fumigants are widely used as insecticides in horticultural and to some extent in veterinary practice. The very simple but quite efficient method used in many places is to prepare tobacco extracts by soaking or macerating tobacco leaves in water. In fact, a large proportion of the insecticides based on nicotine consists of crude tobacco extracts. Other insecticides prepared from tobacco contain nicotine sulphate, nicotine tannate, nicotine bentonite, etc. Nicotine is generally regarded as a contact insecticide, but it appears to act principally as a fumigant and sometimes as a stomach poison. Tobacco (both *Nicotiana tabacum* Linn. and *N. rustica* Linn.) is extensively cultivated in India, and the agriculturists should be educated to use it against insect crop pests.

Quassia (*Picrasma excelsa* Planch.), a foreign species, is also used as an insecticide, and there is every likelihood that some of the allied Indian species possess similar properties. We have recently been informed that powdered young leaves and twigs of *P. javanica* Blume, var. *nepalensis* (Benn.) Badhwar *nov. comb.* (*P. nepalensis* Benn.) are used to destroy mosquito larvae in Assam.

Several Indian species of *Delphinium* are even now used for destroying maggots in wounds and may be potential insecticides. It has also been stated that the alkaloid cytisine is an important constituent of the Persian and Australian insect powder. This alkaloid, which resembles nicotine in its action, has been found in at least six genera of which *Euchresta* and *Sophora* are represented in India. The rhizomes of hellebores (*Veratrum album* Linn. and *V. viride* Ait.), both foreign plants, are quite efficient insecticides, but they have failed to survive the introduction of rotenone-containing insecticides, and are very seldom used nowadays.

Insect-repellent Plants

The importance of insect-repellent plants in the economy of nations is obvious. The cheaper and larger the number of effective insect repellents that could be used from amongst the common indigenous plants, the greater the likelihood of the masses of India benefiting from their use. The leaves of neem (*Azadirachta indica* A. Juss.) and of patchouli (*Pogostemon heyneanus* Benth., syn. *P. patchouli* Fl. Brit. Ind., *non* Pellet.), and the roots of costus (*Saussurea lappa* C. B. Clarke) are used to protect woollen fabrics from insects. Articles placed in boxes made of sandalwood (*Santalum album* Linn.) are immune from the attacks of these pests. Some essential oils, such as the eucalyptus oil from *Eucalyptus globulus* Labill. and citronella oil from *Cymbopogon nardus* (Linn.) Rendle (*Andropogon nardus* Linn.), when applied to the body, give relief from the bites of mosquitoes so long as the odour lasts. Hemp (*Cannabis sativa* Linn.), if spread under a bedsheet, affords ample protection against fleas which disturb sleep at night in many of the hill stations of India. The simple device of mixing of the leaves of *Trigonella foenum-graecum* Linn., *Vitex negundo* Linn., etc., with the grains before storage, especially during the rainy season, as practised by the agriculturists in some parts of this country, saves the produce from the ravages of insects. All these plants contain essential oils, which are well known for their repellent or attracting properties for different kinds of insects. Research is being directed nowadays for finding suitable essential oils for use against particular insects. Pine oil in dilute solution appears to have repellent properties and is being increasingly used as an ingredient of plant sprays, household fly sprays, and cattle sprays. It has a greater solvent power for rotenone than mineral oils, and is believed to possess the important property of increasing the toxicity of pyrethrin and rotenone. Similarly, citronella oil, eucalyptus oil, and oil of wintergreen constitute one of the ingredients for several sprays. The use of repellent sprays for protecting cattle from the attacks of flies nowadays constitutes an integral

part of routine protective measures in all progressive countries of the world, although opinion appears to be still divided as to whether the protection thus afforded results in an actual increase in the yield of milk. Sen (8) reports that the use of a spray consisting of high-speed Diesel oil, 'Pyrocide 20' (a concentrated extract of pyrethrum flowers), and pine oil, when applied on Sahiwal cows for 21 consecutive days proved very effective against some species of biting flies, and resulted in an appreciable increase in the yield of milk. Investigation of suitable plants which, when grown, will keep away mosquitoes from habitations has been engaging the attention of malariologists for some time. No really effective plant for this purpose has so far been discovered but extended trials with the shrubby basil (*Ocimum gratissimum* Linn.), absinthe (*Artemisia absinthium* Linn.), and other plants, which diffuse strong fragrance in the surrounding atmosphere, are likely to yield valuable results.

Control of Mosquito Larvae by Vegetation

Hackett, Russell and others (9) have discussed the naturalistic methods practised for the control of mosquito larvae, and have referred to the role of plant kingdom in this connection. It is stated that pollution by vegetable matter in the form of industrial wastes has often been tried with success as an antimalarial measure. Bagasse from sugarcane mills in the Philippines in one reported case seemed to keep a stream free from *Anopheles flavirostris;* the refuse from the Government Sisal Experiment Station is said to have a similar action, and numerous large pits used for macerating canepa hemp in Italy did not breed anophelines. Stagnant pools, such as engineering borrow-pits into which green-cut vegetation has been thrown are stated to breed culicines only, as no anophelines were found. The lethal effect of a fortnight-old brew of cut grass is said to be remarkable. The extension of this method in the form of 'herbage-packing' to shallow, small volume running channels has been advocated by Williamson and these authors. They are of the opinion that the effect is biological and not mechanical, and advocate the use of green-cut vegetation only, for dry straw results in a hay infusion favourable to larval growth. It is not every plant, however, that is suitable for use in running waters. According to these authors: 'The best so far found in India are *Cleistanthus* species and *Holorrhena antidysenterica* (*sic*). The first of these are fish poisons; the latter contains several alkaloids'. We are confident, however, that many more plants mentioned in the conspectus, which is appended, would be found to be equally good or even better for this purpose. The piscicidal plants cannot, however, be used if the waters contain fishes, or drain into tanks or reservoirs which contain such animal life.

Plants Poisonous to Fishes

For centuries, vegetable products of diverse nature have been used in different parts of the world for poisoning or stupefying

fishes in streams, ponds and pools for facilitating their capture. Wholesale poisoning of fishes by means of these plants is very uneconomical and is not allowed in any civilized country, but cases are known where such plants have come into contact with water and enormous number of fishes have died as a result. As pointed out already a knowledge of the local fish poisons has assumed a great importance in modern times, and a systematic investigation of these plants is gradually leading to discoveries of several potent insecticides. A comprehensive list of Indian piscicidal plants was published by Chopra (**18**) and lately considerable additions to it have been made by Chopra and Badhwar (**1**).

Potentialities in India

India with its great variety of climatic and edaphic conditions is particularly well suited for the cultivation of almost every plant. Vegetable insecticides of such proved value as pyrethrum and derris can be extensively grown in a number of suitable areas. The indigenous vegetation also abounds in potential insecticides and insect repellents, and a search from amongst the resources existing in this vast country will repay scrutiny. A list of those already in use as insecticides and insect repellents, as well as of those which are reputed to have piscicidal properties, is given below. The distribution of such plants in India, their active principles and properties and uses are also briefly mentioned. In addition to the plants detailed in the list, a number of essential-oil-bearing plants could be usefully investigated, especially as insect repellents or for use as valuable adjuncts in sprays.

A perusal of the following conspectus shows that the family Leguminosae contains the largest number of reputed insecticidal plants. Other important families in this connection are: Araceae, Euphorbiaceae, Compositae, Solanaceae, Ranunculaceae and Rubiaceae. The family Leguminosae also contains the largest number of piscicidal plants, while other important families in this respect are: Euphorbiaceae, Rubiaceae, Sapindaceae and Thymelaeaceae.

Name of Plant	Distribution	Constituents	Remarks
1. **Acacia pennata** (Linn.) Willd.	A large scrambling or climbing shrub found in the Central and Eastern Himalayas up to 5,000 ft.; also in Oudh, Bengal, Bihar, and in Central, Western and South India. Reported from the North-West Himalayas.	......	The fruits and stems are used in Burma to poison fish (**10**).
2. **Acorus calamus** Linn.	A semi-aquatic herb found throughout India in marshes or on river banks, wild or cultivated, up to 8,000 ft. on the Himalayas.	An essential oil in all parts (**11**, **12**, **13**). A glucosidic bitter substance in rootstocks (**14**).	Aromatic rootstock used to protect clothes from insect attacks; in powder form effectively employed for destroying fleas in some parts of India.
3. **Acorus gramineus** Soland.	A semi-aquatic herb found in the Khasia Hills and Sikkim Himalayas between 4,000 to 6,000 ft.	Essential oil (**15**).	Rootstock used in China as an insectifuge and insecticide (**16**).
4. **Acronychia pedunculata** (Linn.) Miq. (Syn. **A. laurifolia** Blume)	A small tree found in Dehra Dun, Konkan, North Kanara, the hill forests of the Western Ghats of Madras Presidency up to an altitude of 6,000 ft., South Deccan slopes, Northern Circars, Orissa, Sikkim 3,000 to 4,000 ft., Khasia Hills up to 4,000 ft., Assam and Chittagong.	......	Pammel (**17**) reports it to be a fish poison.
5. **Adina cordifolia** (Roxb.) Benth. & Hook. *f*.	A large deciduous tree found in the Sub-Himalayan tract from the Jumna eastwards, ascending to 3,000 ft. and extending throughout the moister regions of India. (Common in Western India, especially in the forests of Surat, Ratnagiri and Thana districts; also plentiful in Mysore, Upper Godaveri and Bhandvara).	Bitter principle (**18**).	Juice employed to kill maggots in sores.

Name of Plant	Distribution	Constituents	Remarks
6. **Agave americana** Linn.	A stout shrubby plant with a rosette of spiny leaves. A native of America; planted in parks and gardens throughout India.	Acrid volatile oil in the leaves (**19**). A crystalline saponin in the roots (**20**). Leaves likely to contain saponins.	Wall paper impregnated with juice of the leaves is said to be proof against the ravages of white ants (**21**). According to Pammel (**17**), the plant is used as a fish poison in some countries.
7. **Albizzia chinensis** (Osbeck) Merr. (Syn. **A. stipulata** Boiv.)	A large tree found throughout India, ascending to an altitude of 4,000 ft. in the Himalayas.	Saponin (**20**).	Pammel (**17**) records it as a fish poison.
8. **Albizzia procera** (Roxb.) Benth.	A tall tree found in the Sub-Himalayan tracts from the Jumna eastwards; also in Bengal, Bihar and Orissa, Central Provinces, Bombay Presidency and South India, usually in moist places. Occasionally seen as an ornamental or roadside tree.	......	Raizada & Varma (**10**), on the authority of Watt (**21**), state that the bark of this tree, if pounded and thrown into a pond, stupefies fish. We do not, however, find any such reference in his book which they quote. Kirtikar & Basu (**16**) mention that the leaves have insecticidal properties.
9. **Anacardium occidentale** Linn.	A small tree from South America; now established in the coastal districts of South India, Chittagong and the Andaman Islands.	A black, caustic, oily juice containing phenolic compound cardol, anacardic acid and an ether-soluble substance (**22**).	Juice used to protect timber, books, etc., from white ants.
10. **Anagallis arvensis** Linn.	An erect or procumbent annual found over the greater part of India up to an altitude of 8,000 ft. in the Himalayas. The red-flowered variety is found in Kashmir, but the blue-flowered one is more common in India.	Volatile oil (**11**) and two glucosidic saponins have been isolated from the herb, while the root contains cyclamin which is also a glucosidic saponin (**20**).	Used in India to intoxicate fish and to expell leeches from the nostrils of livestock.

11.	**Anamirta cocculus** (Linn.) Wight & Arn.	A large climbing shrub found in Assam, Eastern Bengal, Oudh, Orissa, and Konkan southwards to Ceylon.	Picrotoxin in the seeds (**20**).	A kind of ointment prepared from the drupes employed as an insecticide. They are also used to poison fish.
12.	**Andrachne cordifolia** Muell.-Arg.	An erect shrub met with in the temperate Himalayas from the Indus eastwards to Nepal at 4,000 to 8,000 ft.; common in shady places.	Hydrocyanic acid in the leaves (**17**).	Leaves believed by people in Jammu to have insecticidal properties. The powdered root-bark of *A. ovalis* Muell.-Arg. of Africa, used as a fly exterminator by the Zulus, after it is mixed with milk (**19**).
13.	**Annona reticulata** Linn.	A small American tree. Cultivated, but not so extensively as the following species, *A. squamosa*.	An alkaloid anonaine in the bark (**23**).	Properties similar to *A. squamosa*.
14.	**Annona squamosa** Linn.	An American tree about 20 ft. high. Cultivated and naturalized in several parts of India.	Seeds contain an oil and a resin which contains an acrid principle (**21**). Leaves and seeds contain an amorphous alkaloid (**24**).	The seeds, leaves and the immature fruit contain an acrid principle fatal to insects; the dried unripe fruit, powdered and mixed with gram flour, used for killing vermin and the seeds to kill body lice. The powdered seeds and an aqueous infusion of leaves have valuable insecticidal properties (**25**). Pammel (**17**) records the plant as a fish poison.
15.	**Apama tomentosa** Engl. (Syn. **Bragantia tomentosa** Blume)	Herbaceous plant found in Assam and Manipur.	......	Recorded as a fish poison (**17**).
16.	**Arenga obtusifolia** Mart.	A Malayan palm, found in India only under cultivation.	......	In the Philippine Islands it is used for poisoning fishes (**16**).

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6. **Agave americana** Linn.	A stout shrubby plant with a rosette of spiny leaves. A native of America; planted in parks and gardens throughout India.	Acrid volatile oil in the leaves (**19**). A crystalline saponin in the roots (**20**). Leaves likely to contain saponins.	Wall paper impregnated with juice of the leaves is said to be proof against the ravages of white ants (**21**). According to Pammel (**17**), the plant is used as a fish poison in some countries.
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9. **Anacardium occidentale** Linn.	A small tree from South America; now established in the coastal districts of South India, Chittagong and the Andaman Islands.	A black, caustic, oily juice containing phenolic compound cardol, anacardic acid and an ether-soluble substance (**22**).	Juice used to protect timber, books, etc., from white ants.
10. **Anagallis arvensis** Linn.	An erect or procumbent annual found over the greater part of India up to an altitude of 8,000 ft. in the Himalayas. The red-flowered variety is found in Kashmir, but the blue-flowered one is more common in India.	Volatile oil (**11**) and two glucosidic saponins have been isolated from the herb, while the root contains cyclamin which is also a glucosidic saponin (**20**).	Used in India to intoxicate fish and to expell leeches from the nostrils of livestock.
11. **Anamirta cocculus** (Linn.) Wight & Arn.	A large climbing shrub found in Assam, Eastern Bengal, Oudh, Orissa, and Konkan southwards to Ceylon.	Picrotoxin in the seeds (**20**).	A kind of ointment prepared from the drupes employed as an insecticide. They are also used to poison fish.
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15. **Apama tomentosa** Engl. (Syn. **Bragantia tomentosa** Blume)	Herbaceous plant found in Assam and Manipur.	......	Recorded as a fish poison (**17**).
16. **Arenga obtusifolia** Mart.	A Malayan palm, found in India only under cultivation.	......	In the Philippine Islands it is used for poisoning fishes (**16**).

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17. **Arisaema speciosum** (Wall.) Mart.	Tuberous herb found in the temperate Himalayas from Hazara to Sikkim and Bhutan at 7,000 to 10,000 ft.	Acrid juice.	Properties similar to *A. tortuosum.*
18. **Arisaema tortuosum** (Wall.) Schott	A tall tuberous herb found in the temperate and subtropical Himalayas from Simla to Bhutan at about 8,000 ft.; also in Khasia Hills, Manipur, Chota Nagpur, Ranchi and Parasnath. In Western India, met with in Konkan; and in the Madras Presidency in Rampa Hills at 4,500 ft., Horsleykonda at 4,000 ft., and in the Western Ghats at 3,000 to 4,000 ft.	Acrid juice.	The tubers are used to kill worms which infest cattle during the rainy season. A decoction from the tubers prepared from some other species of *Arisaema* also used to kill insects in India and abroad.
19. **Aristolochia bracteata** Retz.	A slender prostrate herb growing on the banks of the Jumna and the Ganges, and in Bundelkhand, Sind and Konkan. In the Madras Presidency found in the Northern Circars, the Deccan and Carnatic, on dry especially the black cotton soil. Its occurrence in Bihar is doubtful.	A nauseous volatile substance and an alkaloid (**26**).	Juice applied to foul and neglected ulcers to destroy insect larvae. The vernacular name, *kirimar* (insect killer), is expressive of this fact.
20. **Artemisia Absinthium** Linn.	An aromatic herbaceous perennial met with in Kashmir and Kurrum Agency at 5,000 to 7,000 ft.	Volatile oil (**20**), a bitter glucoside absinthin (**27**) and a bitter substance anabsinthin (**20**).	Used to protect garments from moths.
21. **Artemisia vulgaris** Linn.	A gregarious shrub-like herb found throughout the mountainous tracts of India, especially between 5,000 and 12,000 ft.	Yields an essential oil containing α-thujone, borneol, etc. (**28**).	Used to prevent moths and other insects from infesting clothes and furniture.

22. **Asclepias curassavica** Linn.	A native of the West Indies; often grown in gardens and has become naturalized in many parts of India.	The herb contains the glucoside asclepiadin (**29**, **30**). The roots contain vincetoxin (**31**), which closely resembles emetine in its physiological action (**26**).	Used to procure fish in the West Indies and in Queensland.
23. **Azadirachta indica** A. Juss. (Syn. **Melia azadirachta** Linn.).	A large evergreen tree planted all over India; doubtfully indigenous to the Jhelum Valley.	Amorphous bitter principle and a crystalline substance, margosopicrin. Seeds also contain a bitter fixed oil with objectionable odour due to the presence of sulphur compounds and some fatty acids (**32**).	Leaves largely employed to protect woollen fabrics and books from insect attacks.
24. **Balanites roxburghii** Planch.	A shrub or small evergreen tree found in the drier parts of India extending from South-East Punjab and Delhi to Sikkim, Bengal, Central India, Bombay Presidency and South India.	The flesh of the fruit contains about 7·2 per cent of saponins (**33**).	The bark is used in several places in India and by African Arabs as a fish poison.
25. **Bambusa arundinacea** Willd.	A common bamboo in Central and South India; cultivated in many places in North-West India and Bengal.	Benzoic acid and traces of cyanogenetic glucoside in shoots (**34**).	Shoots have lethal action on mosquito larvae (**34**).
26. **Barringtonia acutangula** (Linn.) Gaertn.	A small or medium-sized tree most plentiful in Bengal, especially near the coast beyond the tidal range. It is also frequently found in Kanara and Bombay along the banks of streams.	The fruits contain two saponins.	The bark is used to stupefy fish in many parts of India. The seeds and roots are also said to be used for the same purpose (**26**).
27. **Barringtonia asiatica** (Linn.) Kurz (Syn. **B. speciosa** Forst.)	A rather small or moderate-sized tree which is a native of the Andaman Islands, Singapore and Ceylon. It also occurs on the Southern Deccan Peninsula, but not in a wild state.	The active principle of bark is stated to be a volatile oil combined with a resin (**21**). The seeds contain 3·27 per cent of a glucosidic saponin, barringtonin, and 1 per cent of a substance designated as barringtogenetin (**35**).	The plant possesses narcotic properties and stupefies fish without killing them. The seeds are also said to be a fish poison.

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Name of Plant	Distribution	Constituents	Remarks
28. **Barringtonia racemosa** (Linn.) Roxb.	An evergreen ornamental tree common along the Western Coast from Konkan to Travancore and from the Sundarbans eastwards.	......	The seed is used as a household vermifuge in Madagascar and is stated to be a fish poison (**17**). The plant possesses toxic and insecticidal properties (**36**).
29. **Berberis aristata** DC. (possibly some other species of **Berberis** also)	A robust shrub found in Garhwal, Jaunsar and Nepal.	......	The plant is mentioned by Pammel as a fish poison (**17**).
30. **Butea monosperma** (Lam.) Kuntze (Syn. **B. frondosa** Koen. **ex** Roxb.)	A small or medium-sized tree common throughout the greater part of India up to 3,000, sometimes up to 4,000 ft.	Fixed oil, a small quantity of a resin and a large quantity of a water-soluble albuminoid in the seeds (**18**).	Maggots are killed by sprinkling the powdered seeds over them (**16**).
31. **Caesalpinia nuga** (Linn.) Ait.	A large prickly climber found on the banks of rivers near the coast, *e.g.*, in Konkan, West Ccast, Orissa, Sundarbans and Eastern Bengal near Chittagong, and in Sylhet.	......	The pulped fruit and stems yield a fish poison (**10**).
32. **Callicarpa longifolia** Lam., var. **lanceolaria** C. B. Clarke	A shrub occurring plentifully in Central Bengal, Tippera, Chittagong and in the Khasia Hills up to an altitude of about 3,000 ft.	......	Pammel (**17**) records *C. longifolia* as poisonous to fishes. It is likely that the variety *lanceolaria* also is a fish poison.
33. **Calonyction muricatum** (Linn.) G. Don (Syn. **Ipomoea muricata** Jacq.)	A large twiner found in the Himalayas from Kangra to Sikkim up to an altitude of 5,000 ft., and also in the Upper Gangetic Plain, Bengal and Deccan Hills; it is often cultivated for the sake of its thickened pedicels which are edible.	Seeds contain a resin (**19**).	The juice of the plant is used to destroy bugs (**21**).

34. **Calophyllum Inophyllum** Linn.	An exceedingly handsome moderate-sized tree cultivated throughout India, especially near the sea, as an ornamental plant.	Saponins (**17**).	The plant according to Pammel is a fish poison (**17**).
35. **Cannabis sativa** Linn.	An aromatic resinous annual herb found in several parts of India on waste ground and by the roadside. In the Himalayas it grows wild and is widely distributed.	Resinous substance which contains about 33 per cent of a toxic red oil (**37, 38, 39**).	Has the property of driving away bugs. For this purpose, the leaves or the whole plant are scattered under the bedsheet, which is effective in getting relief from these pests.
36. **Careya arborea** Roxb.	A medium-sized tree frequently found in the Sub-Himalayan tract from the Jumna eastwards, and in Bengal, Central, Western and Southern India, ascending to an altitude of 5,000 ft.	The leaves and wood contain tannins, the former to the extent of 19 per cent (**20**).	The Mundas of Chota Nagpur use the root, bark and the leaves to kill fish (**16**). In Mysore the inner bark is rubbed on the shoes to ward off leeches and is said to be quite effective for this purpose.
37. **Casearia graveolens** Dalz.	A shrub or small tree found in the Upper Gangetic Plain, westwards to Chenab ascending to an altitude of 5,000 ft. and in Garhwal, Kumaon and the Deccan Peninsula. In Sikkim it is found at an altitude of 1,500 ft.	......	The fruit is used to poison fish.
38. **Casearia tomentosa** Roxb.	A shrub or small tree common throughout India especially in open lands, ascending to 3,000 ft. in the Himalayas.	......	According to Brandis, the fruit yields a milky acrid juice which is employed to poison fish (**21**). Sometimes the crushed fruit is used for the same purpose.
39. **Cassytha filiformis** Linn.	A wiry leafless twining parasite found throughout the greater part of India, especially near the seacoast.	Alkaloid (**40**).	According to Pappe, quoted by Watt and Breyer-Brandwijk (**19**), it has been used as a wash in 'scald head and for the destruction of vermin'.

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Name of Plant	Distribution	Constituents	Remarks
40. **Centratherum anthelminticum** (Willd.) Kuntze (Syn. **Vernonia anthelmintica** Willd.).	A tall annual met with throughout India up to 5,000 ft. on the Himalayas and Khasia Hills.	Bitter principle in the seeds (**41**).	In Travancore, the bruised seeds ground up into a paste with lime juice are largely employed for destroying pediculi in the head and body. The plant roasted in a room, or pounded and thrown about the floor, is believed to expel fleas; hence the popular English name, purple fleabane (**21**).
41. **Cerbera manghas** Linn. (Syn. **C. odollam** Gaertn.)	A small tree or a large shrub found throughout India in the salt swamps or on the seacoast. It is abundant on the Malabar coast but not very common in the Bombay Presidency and elsewhere.	The seeds contain a poisonous glucoside, cerberin, having a digitalis-like action.	Pammel (**17**) records the plant as a fish poison.
42. **Chrysanthemum cinerariifolium** Vis.	A glaucous perennial, experimentally cultivated in some parts of India, especially in the North-Western Himalayas.	Pyrethrin I and pyrethrin II in flower-heads (**42**). These, however, do not appear to be the only insecticidal principles in the plant, as watery extracts of the flower-heads are also toxic to mosquito larvae (**43**).	The flower-heads of pyrethrum have of recent years gained very great importance because of their insecticidal properties. They are employed in the form of powder or as a prepared extract for use as (*a*) household insecticides, (*b*) as livestock sprays, and (*c*) as horticultural dusts and sprays. Till recently Japan and Yugoslavia were the biggest producers of pyrethrum, but of late years Kenya is assuming increasing importance. It is also being grown

			on a commercial scale in Persia, Algeria, Australia, Brazil, France, Spain and Switzerland. Examination of various samples of flower-heads of *C. cinerariifolium* cultivated in Kashmir and Murree hills has shown 0·702 to 1·300 per cent of pyrethrins, which compares favourably with foreign-grown commodity which is imported. The biological tests against different species of mosquitoes and flies have also shown that the Indian-grown stuff compares favourably with the flower-heads imported from Japan and also with another powerful proprietary extract sold under the name of 'Pyrocide 20'. Thus both the chemical and biological tests carried out in connection with pyrethrum grown in India, lead to the conclusion that the cultivation of *C. cinerariifolium* should be extended at a rapid rate so that the large and growing demand for it in this country is met with (**43**).
43. **Chrysanthemum coccineum** Willd.	A glabrous perennial, experimentally cultivated in Murree and some other places in India.	See under *C. cinerariifolium*.	A very important insecticide but not nearly as efficacious as *C. cinerariifolium*, at least in case of specimens grown in India (**43**).

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Name of Plant	Distribution	Constituents	Remarks
44. **Cimicifuga foetida** Linn.	A tall robust perennial found in the Himalayas from Kashmir to Bhutan at 7,000 to 12,000 ft.	Rhizomes of *C. racemosa* (Linn.) Nuttal, a foreign species, contain a saponin, a glucosidic tannin, a water-soluble glucoside, and a glucoside insoluble in water but soluble in alcohol (**44**). They also contain an essential oil. It is possible that the Indian plant contains identical or similar constituents.	The roots are used to drive away bugs and fleas in Siberia; the flowers and unripe fruits have an extremely foetid smell and probably have the same property; hence its English name, bugbane.
45. **Cinchona calisaya** Wedd.	A native of Bolivia and Peru, this species may be said to have succeeded well under Indian climatic conditions, and is largely cultivated in Sikkim at elevations of 1,500 to 3,000 ft. above sea level.	A number of alkaloids (about 20 in number), which resemble each other in their chemical and pharmacological properties, have been isolated from this and other species of *Cinchona*. The best known of these are quinine, quinidine, cinchonine and cinchonidine. Besides these alkaloids, cinchona bark contains a few free organic acids, tannins, some neutral substances, colouring matters, traces of volatile oil, etc.	According to Pammel (**17**), various species of *Cinchona* are poisonous to fishes.
C. calisaya Wedd., var. **ledgeriana** Howard	Cultivation of this variety is now being developed in all Indian plantations and is gradually replacing *C. succirubra* Pav. *ex* Klotzsch. It is largely cultivated in Java and yields the most plentiful supply of quinine of all the species.	Ditto.	Ditto.

46. **Cinchona officinalis** Linn.	This species, with several varieties, is a native of Peru and Ecuador at an elevation of 5,000 to 7,500 ft. It is cultivated in South India in the Nilgiris near Ootacamund and thrives at higher altitudes (between 6,000 to 8,000 ft.) better than any other species. The cultivation of this species has been practically abandoned in Sikkim, as the climate is found to be too moist.	Ditto.	Ditto
47. **Cinchona succirubra** Pav. *ex* Klotzsch	This plant is a native of Ecuador and is largely cultivated in South India at an altitude of 4,500 to 6,000 ft. It is also grown in the Government of Bengal Plantations at Mungpoo (Sikkim), and in parts of the Satpura Range in Central India. It has proved to be the hardiest and most easily cultivated species and succeeds well at altitudes of 3,000 to 6,000 ft.	Ditto.	Ditto.
48. **Cinnamomum camphora** Nees & Eberm.	A small tree indigenous to Formosa, China and Japan; planted in some gardens in India up to 4,000 ft. in the North-West Himalayas.	Source of camphor.	Camphor is used to protect woollen fabrics against insects and enters into the composition of several insecticidal preparations.
49. **Cleistanthus collinus** Benth. & Hook. *f.*	A small tree found in the dry forests of Bundelkhand, Chota Nagpur, Central Provinces, Orissa, Northern Circars, Carnatic, the Deccan especially in Hyderabad, and Malabar.	The bark contains saponins and tannins (**45**).	The root, leaf, bark and fruit are employed as a poison for fish.
50. **Corypha umbraculifera** Linn.	A magnificent palm found in the moist forests of the Kumpta and Honavar talukas of North Kanara,	......	The young fruit is pounded up and used for stupefying fishes (**46**).

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C. **calisaya** Wedd., var. **ledgeriana** Howard	Cultivation of this variety is now being developed in all Indian plantations and is gradually replacing *C. succirubra* Pav. *ex* Klotzsch. It is largely cultivated in Java and yields the most plentiful supply of quinine of all the species.	Ditto.	Ditto.
46. **Cinchona officinalis** Linn.	This species, with several varieties, is a native of Peru and Ecuador at an elevation of 5,000 to 7,500 ft. It is cultivated in South India in the Nilgiris near Ootacamund and thrives at higher altitudes (between 6,000 to 8,000 ft.) better than any other species. The cultivation of this species has been practically abandoned in Sikkim, as the climate is found to be too moist.	Ditto.	Ditto
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48. **Cinnamomum camphora** Nees & Eberm.	A small tree indigenous to Formosa, China and Japan; planted in some gardens in India up to 4,000 ft. in the North-West Himalayas.	Source of camphor.	Camphor is used to protect woollen fabrics against insects and enters into the composition of several insecticidal preparations.
49. **Cleistanthus collinus** Benth. & Hook. *f.*	A small tree found in the dry forests of Bundelkhand, Chota Nagpur, Central Provinces, Orissa, Northern Circars, Carnatic, the Deccan especially in Hyderabad, and Malabar.	The bark contains saponins and tannins (**45**).	The root, leaf, bark and fruit are employed as a poison for fish.
50. **Corypha umbraculifera** Linn.	A magnificent palm found in the moist forests of the Kumpta and Honavar talukas of North Kanara,	......	The young fruit is pounded up and used for stupefying fishes (**46**).

Name of Plant	Distribution	Constituents	Remarks
50. **Corypha umbraculifera** Linn.—(*continued.*)	covering extensive areas near the Gairsoppa and Yena rivers, also on the Yellapur Ghats. It also occurs in Malabar and Travancore but in a doubtfully wild state. In the rest of tropical India it is occasionally cultivated.		
51. **Croton oblongifolius** Roxb.	A small deciduous tree found in the Sub-Himalayan tract from Oudh eastwards; also in Bengal, Sylhet, Chota Nagpur, and in the Central, Western and Southern India.	......	The seeds have an oil with properties similar to those of *C. tiglium.*
52. **Croton tiglium** Linn.	A small evergreen tree planted in gardens more or less throughout India; almost becoming naturalized in Bengal and Assam.	Seeds contain an oil which is the most violent of all cathartics. They also contain an alkaloid, ricinine, and two toxic proteins (**20**).	The oil is sometimes used as an insecticide. The fruit is employed in some foreign countries to poison fishes (**17**).
53. **Cucumis sativus** Linn (wild form)	A hispidly hairy climber cultivated in all warm and warm-temperate countries. It is also found wild in Northern India.	The fruits contain a proteolytic enzyme resembling erepsin (**47**). They are also found to contain a bitter substance, the nature of which has not been ascertained.	It has been said that the juice banishes wood lice and fish insects; freshly cut slices are strewn in their haunts for this purpose.
54. **Curcuma longa** Roxb.	A tuberous herb, extensively cultivated all over India for its rhizomes known as turmeric.	Essential oil, alkaloid (**18**).	Turmeric is used to drive away ants by sprinkling in powder form on the ant holes. There are about fifteen species of *Curcuma* growing wild in India, and most of these could be used for similar purpose.

55. **Cymbopogon nardus** (Linn.) Rendle (Syn. **Andropogon nardus** Linn.)	A tall aromatic grass cultivated for the sake of its aromatic oil. According to some authors, this plant is also found wild in India.	Essential oil known as oil of citronella obtained from the leaves.	The commercial supply of oil of citronella is obtained principally from Ceylon, Burma and the Straits Settlements. It is an important constituent of mosquito repellents found in the market.
56. **Cynanchum Arnottianum** Wight	An erect plant found in Kashmir at 6,000 to 8,000 ft.; also in Baluchistan.	......	The leaves are dried and powdered, and used to destroy the maggots which infest wounds in animals.
57. **Dalbergia stipulacea** Roxb.	A large climbing shrub, often a small erect tree found in the Eastern Himalayas up to 4,000 ft.; also in Assam, Khasia Hills and Chittagong.	......	The bark and root of this plant are stated to be used to poison fishes (**10**).
58. **Delphinium brunonianum** Royle	An erect simple herb found in the Western Himalayas and Tibet between 13,000 and 17,000 ft.	*Note.*—Various species of *Delphinium* contain alkaloids, such as ajacine, ajaconine, delcosine, delphinine, delphinoidine, staphisagroine, etc.; of these delphinine and staphisagroine are the most important. *D. brunonianum* and *D. caeruleum* have not been analyzed so far.	Aitchison (**48**) remarks that the juice of the leaves is used in Kurrum Agency to destroy ticks on animals, particularly when they affect sheep.
59. **Delphinium caeruleum** Jacquem. *ex* Cambess.	An erect herb met with on the alpine Himalayas from Kumaon to Sikkim; common in the Sutlej basin at 8,000 to 17,000 ft.		The root is applied to kill maggots in the wounds of goats (**21**).
60. **Delphinium elatum** Linn.	Sparingly branched herb found in the temperate Western Himalayas from Kashmir to Kumaon and in the inner Tibetan Valleys at 10,000 to 12,000 ft.	Alkaloids (**49**).	In Europe the seeds are used as an insecticide (**21**).

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60. **Delphinium elatum** Linn.	Sparingly branched herb found in the temperate Western Himalayas from Kashmir to Kumaon and in the inner Tibetan Valleys at 10,000 to 12,000 ft.	Alkaloids (**49**).	In Europe the seeds are used as an insecticide (**21**).

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61. **Derris elliptica** (Roxb.) Benth.	A large, handsome climber reported from Kodala Hill near Chittagong. Commercial supply comes mostly from Malaya, Sarawak, British North Borneo, and the Dutch East Indies. Attempts being made to cultivate this plant in different parts of India, such as Travancore, the Punjab, Kashmir, Mysore and Dehra Dun.	Roots contain rotenone, deguelin, tephrosin, *iso*tephrosin, toxicarol, dehydrorotenone and other substances ; of these rotenone is said to be the most important (**20**, **50**, **51**, **52**). In commercial assay of tuba roots the total resinous content is regarded as a measure of its toxicity irrespective of the amount of crystalline rotenone because noncrystalline resin is also equally toxic. The fine lateral roots have been stated to contain higher toxic content than the larger tap roots.	The root, known as tuba root or derris, is an important article of commerce on account of being a valuable horticultural and agricultural insecticide. It is useful against many caterpillars, probably all larvae of leaf-eating wasps, many beetles and their larvae, turnip fleas, flower wasps, plant lice and red spider. In animal husbandry it has proved very effective against the larvae of warble fly, poultry pests such as red poultry mite, and forms the basis of proprietary sheep dip. An insecticidal wash effective against a wide range of pests may be made by adding 1 lb. of powdered root and 4 oz. of soft soap to 1 gallon of water (**50**). The powdered root mixed with forty parts of talc makes a very good insect powder for dogs and cats. The toxicity of tuba roots varies with the age of the plant. Harvesting of plant about 23 months after planting is recommended. The tuba root is also poisonous to fishes. *Note.*—Over twenty other species of *Derris* are found in India. It is very likely that a number of them possess piscicidal

			and insecticidal properties, and it would be worth-while investigating their properties. Besides the following species, only *D. robusta* (Roxb. *ex* DC.) Benth. has so far been investigated and shown to be devoid (**53**) of insecticidal properties.
62. **Derris ferruginea** (Roxb.) Benth.	A woody climber found in the evergreen forests of Upper Assam down to Darrang and Sibsagar.	Yields a fair amount of rotenone—up to 2·4 per cent (**54**, **55**).	Because of the presence of rotenone, it is very likely that this plant possesses piscicidal and insecticidal properties.
63. **Derris scandens** (Roxb.) Benth.	A very large climber found in the forests of North Oudh, Konkan, Kanara, Madras Presidency from Northern Circars southwards, Bengal especially near Chittagong, and Orissa. It is also sometimes cultivated in gardens.	......	Used as a fish poison. Devoid of insecticidal properties (**54**).
64. **Derris trifoliata** Lour., var. **uliginosa** (Roxb. *ex* Willd.) Badhwar *nov. comb.* (Syn. **D. uliginosa** Benth.; **Robinia uliginosa** Roxb. *ex* Willd.)	A large climber found on the muddy seacoast and creeks of the Bombay and Madras Presidencies and near the sea from Cuttack tidal forests to Puri (near the Chilka Lake); also in Sundarbans and Chittagong in Bengal, and in Assam.	Power (**56**) examined the stem-bark and found it to contain 9.3 per cent of tannic acid and some resins, and concluded that the toxic effects of the plant were probably due to some constituents of the resin. Krishna & Ghose (**54**), who examined the roots in different seasons of the year, state 'the total ether extract of these roots which is supposed to extract most of the insecticidal principle, was found to vary from 1·2 to 1·9 per cent and although the ether solubles gave distinct colour test for rotenone and allied bodies, no rotenone could be isolated'.	The bark of this plant is used as a fish poison. The plant possesses very poor insecticidal properties (**54**).

Name of Plant	Distribution	Constituents	Remarks
61. **Derris elliptica** (Roxb.) Benth.	A large, handsome climber reported from Kodala Hill near Chittagong. Commercial supply comes mostly from Malaya, Sarawak, British North Borneo, and the Dutch East Indies. Attempts being made to cultivate this plant in different parts of India, such as Travancore, the Punjab, Kashmir, Mysore and Dehra Dun.	Roots contain rotenone, deguelin, tephrosin, *iso*tephrosin, toxicarol, dehydrorotenone and other substances; of these rotenone is said to be the most important (**20**, **50**, **51**, **52**). In commercial assay of tuba roots the total resinous content is regarded as a measure of its toxicity irrespective of the amount of crystalline rotenone because noncrystalline resin is also equally toxic. The fine lateral roots have been stated to contain higher toxic content than the larger tap roots.	The root, known as tuba root or derris, is an important article of commerce on account of being a valuable horticultural and agricultural insecticide. It is useful against many caterpillars, probably all larvae of leaf-eating wasps, many beetles and their larvae, turnip fleas, flower wasps, plant lice and red spider. In animal husbandry it has proved very effective against the larvae of warble fly, poultry pests such as red poultry mite, and forms the basis of proprietary sheep dip. An insecticidal wash effective against a wide range of pests may be made by adding 1lb. of powdered root and 4 oz. of soft soap to 1 gallon of water (**50**). The powdered root mixed with forty parts of talc makes a very good insect powder for dogs and cats The toxicity of tuba roots varies with the age of the plant. Harvesting of plant about 23 months after planting is recommended. The tuba root is also poisonous to fishes. *Note.*—Over twenty other species of *Derris* are found in India. It is very likely that a number of them possess piscicidal and insecticidal properties, and it would be worth-while investigating their properties. Besides the following species, only *D. robusta* (Roxb. *ex* DC.) Benth. has so far been investigated and shown to be devoid (**53**) of insecticidal properties.
62. **Derris ferruginea** (Roxb.) Benth.	A woody climber found in the evergreen forests of Upper Assam down to Darrang and Sibsagar.	Yields a fair amount of rotenone—up to 2·4 per cent (**54**, **55**).	Because of the presence of rotenone, it is very likely that this plant possesses piscicidal and insecticidal properties.
63. **Derris scandens** (Roxb.) Benth.	A very large climber found in the forests of North Oudh, Konkan, Kanara, Madras Presidency from Northern Circars southwards, Bengal especially near Chittagong, and Orissa. It is also sometimes cultivated in gardens.	......	Used as a fish poison. Devoid of insecticidal properties (**54**).
64. **Derris trifoliata** Lour., var. **uliginosa** (Roxb. *ex* Willd.) Badhwar *nov. comb.* (Syn. **D. uliginosa** Benth.; **Robinia uliginosa** Roxb. *ex* Willd.)	A large climber found on the muddy seacoast and creeks of the Bombay and Madras Presidencies and near the sea from Cuttack tidal forests to Puri (near the Chilka Lake); also in Sundarbans and Chittagong in Bengal, and in Assam.	Power (**56**) examined the stem-bark and found it to contain 9.3 per cent of tannic acid and some resins, and concluded that the toxic effects of the plant were probably due to some constituents of the resin. Krishna & Ghose (**54**), who examined the roots in different seasons of the year, state 'the total ether extract of these roots which is supposed to extract most of the insecticidal principle, was found to vary from 1·2 to 1·9 per cent and although the ether solubles gave distinct colour test for rotenone and allied bodies, no rotenone could be isolated'.	The bark of this plant is used as a fish poison. The plant possesses very poor insecticidal properties (**54**).

Name of Plant	Distribution	Constituents	Remarks
65. **Dioscorea hispida** Dennst. (Syn. **D. daemona** Roxb.)	A climbing plant found throughout India up to an altitude of 2,500 ft. in the Himalayas and up to 4,000 ft. in the Khasia and Naga Hills. It is, however, absent from the plains of Bengal.	Tubers contain an alkaloid called dioscorine (**57**), which runs through the whole plant (**58**).	In the Philippine Islands, poultices of the tubers are applied to wounds which are infested with maggots, to kill them (**58**). Fishes are stated to be poisoned by the tubers. According to Gimlette (**59**), the leaves are also used to poison fishes.
66. **Dioscorea prazeri** Prain & Burkill (Syn. **D. deltoidea** Wall., var. **sikkimensis** Prain)	A climbing plant found in the hill tracts of Northern Bengal, Nepal and Khasia Hills up to 5,500 ft.	Poisonous saponins (**58**).	The Lepchas use the rhizome of this plant as a substitute for soap for washing their hair, because it kills lice. They also employ it as a fish poison.
67. **Diospyros ebenum** Koen.	A large or moderate-sized tree found in the forests of Peninsular India and Assam.	......	Pammel records it as a fish poison (**17**).
68. **Diospyros montana** Roxb.	A small or medium-sized tree found throughout India, *e.g.* in the Sub-Himalayan tract from Kangra eastwards, Upper Gangetic Plain, Bihar, Konkan, Southern Mahratta Country, Northern Circars, the Deccan, Carnatic and eastern slopes of the Ghats.	......	The fruit is stated to be used by the hillmen of Travancore for poisoning fish (**26**). Crushed leaves are used for the same purpose in Chota Nagpur (**16**).
69. **Diospyros paniculata** Dalz	A middle-sized West Peninsular tree found in the forests of Southern Mahratta Country, Kanara, Malabar and Travancore up to 3,000 ft. above sea level.	......	The leaves are used as a fish poison (**16**).

Name of Plant	Distribution	Constituents	Remarks
138. **Ruta graveolens** Linn., var. **angustifolia** Hook. *f.*	Cultivated in gardens.	A volatile oil in the leaves, roots and seeds. Also a glucoside, rutin, and a coumarin-like odoriferous principle (**19**).	The plant is sometimes spread on beds to keep off insects.
139. **Santalum album** Linn.	A small evergreen tree, parasitic on roots to start with. Found in Mysore, Coorg, Coimbatore and Salem districts, southwards to Madura and northwards to Kolhapur; wild or cultivated.	Essential oil in the aromatic heartwood of the tree; also in roots.	The essential oil is an efficient insecticide and insect repellent. The wood is largely used in ornamental carving and cabinet work; its odour drives away insects and it is, therefore, of value for making chests and boxes. Small chips and raspings of the heartwood would serve the purpose of keeping off insects, when placed among clothes, at the same time imparting a pleasant odour.
140. **Sapindus mukorossi** Gaertn.	A handsome tree cultivated throughout North-West India, Bengal and Assam; also found wild in the Himalayas up to an altitude of 4,000 ft.	The fruits contain fairly large amounts of saponins—10·5 per cent (**33**).	The plant is described as a fish poison by Pammel (**17**).
141. **Sapindus trifoliatus** Linn.	A handsome tree common about the villages in South and West India; also cultivated in Bengal where it is doubtfully native. It is occasionally planted elsewhere also.	The pericarp contains a fairly large quantity of saponins—11·5 per cent (**99**). According to Brannt, quoted by Watt (**20**), no saponins are contained in the stone	Pammel (**17**) records it as a fish poison. It is more than probable that *S. emarginatus* Vahl, which is treated as a synonym of *S. trifoliatus* in the **Fl. Brit. Ind.**, but which is now regarded as distinct species, possesses similar properties. The fruits of both are

			The unripe fruit is used to intoxicate fish, and according to Watt (**21**), the bruised root is also employed for this purpose.
133. **Randia uliginosa** DC.	A small rigid tree found in the Eastern, Central and Southern India, but is not common northwards.	......	The unripe fruits are employed for poisoning fish.
134. **Rauwolfia serpentina** Benth. *ex* Kurz	An erect shrub found in Sub-Himalayan tracts and in the plains near the foot of the hills from Sirhind eastward to Assam, ascending to an altitude of 4,000 ft.; also in Konkan, North Kanara, Southern Mahratta Country, Western and Eastern Ghats of the Madras Presidency (up to 3,000 ft.), many districts of Bihar such as Patna and Bhagalpur, and in North and Central Bengal.	Chemical analysis of the root has yielded five crystalline alkaloids which can be classified into two groups: (**A**) the ***ajmaline*** group—ajmaline, ajmalinine and ajmalicine; and (**B**) the ***serpentine*** group—serpentine and serpentinine (**97**). Besides these, there are some more alkaloids present in both the ajmaline as well as the serpentine group.	Pammel (**17**) records this plant as a fish poison, but such use has not been observed by the present authors in India.
135. **Rhododendron barbatum** Wall. *ex* G. Don	A tree found in the temperate Himalayas from Kumaon to Bhutan at altitudes of 8,000 to 12,000 ft.; common in Sikkim.	Contains the toxic substance andromedotoxin (**88**).	The plant is mentioned by Chopra (**18**) to be a fish poison.
136. **Rhododendron falconeri** Hook. *f.*	A tree common in the Himalayas from East Nepal to Bhutan at altitudes of 9,000 to 13,000 ft.	Contains a toxic substance, andromedotoxin (**88**).	Chopra (**18**) mentions the plant as a fish poison.
137. **Ricinus communis** Linn.	A tall stout annual, or perennial and sub-arboraceous. Originally probably from America, it is now extensively cultivated for its oil-bearing seeds and has also become naturalized near habitations in many parts of India.	Seeds contain a fixed oil and a toxalbumin, ricin, which does not pass into the oil (**98**).	Castor oil is said to be an active poison for flies (**98**). Pammel (**17**) records the plant as a fish poison.

Name of Plant	Distribution	Constituents	Remarks
129. **Polygonum hydropiper** Linn.—(*continued*).		Root said to contain oxymethyl-anthraquinones (**93**).	are informed that it is used as a fish poison in the Punjab hills. It is very likely that some other plants belonging to the genus *Polygonum*, especially *P. persicaria* Linn., possess similar properties.
130. **Pongamia pinnata** (Linn.) Merr. (Syn. **P. glabra** Vent.)	A moderate-sized almost evergreen tree met with all over India, on the banks of rivers and streams, especially near the seacoast and some forest localities; often planted as a roadside tree. It sometimes flowers as a shrub on the seacoast.	The seeds contain 27 to 36·4 per cent of a bitter fatty oil and traces of an essential oil (**18**).	The seeds and roots are said to be poisonous to fishes. A 2 per cent *P. glabra* oil-resin spray has been stated to be highly toxic against the nymph and adult stages of the green bug (*Coccus viridis*) on coffee (**94**).
131. **Pygeum gardneri** Hook. *f.*	A medium-sized tree found in the Western Ghats of Madras and Bombay Presidencies, in the hills of Travancore, Malabar, Nilgiris, Pulneys, the Deccan, Southern Mahratta Country, and Konkan at altitudes above 3,000 ft.; common on the Mahableshwar plateau.	The seeds smell strongly of hydrocyanic acid.	The kernel of the fruit is used as a fish poison.
132. **Randia dumetorum** Lam. [Split up into three species by Gamble (**126**)]	A small tree or rigid shrub found in the Sub-Himalayan tracts from Rawalpindi district eastwards, ascending in Sikkim up to 4,000 ft. Southwards it extends to Chittagong and the Peninsular India.	The fruits contain saponin in the pericarp, a glucosidic saponin in the pulp, and the seeds are said to contain traces of an alkaloid (**95**). An essential oil also present (**18**).	In Konkan the bruised fruit is mixed with grain to preserve it from the attacks of insects (**26**). Subramaniyam (**96**) found that a 10 per cent aqueous extract of the root sprayed against the green scale of coffee gave an 80 per cent mortality of the insects in 4 days.

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125. **Pieris ovalifolia** D. Don	A small deciduous tree found in the outer Himalayas from the Indus eastwards, usually from 3,000 to 8,000 ft.; common east of the Ravi and in the Khasia Hills between 3,000 to 5,000 ft.	A toxic substance, andromedotoxin (**88**).	The young leaves are believed by people in Jammu to have insecticidal properties.
126. **Pithecellobium bigeminum** Mart. (Syn. **Pithecolobium bigeminum**) Benth.)	A middle-sized unarmed tree found in the Eastern Himalayas, Khasia and Jaintia Hills, Konkan, North and South Kanara, the Western Ghats of Madras Presidency from Mysore to Anamalais and Travancore, ascending to an altitude of 3,000 ft.	The bark contains 0·8 per cent of an alkaloid, which acts as a fatal poison to fish in a dilution of 1: 400,000 (**89**); it also contains a saponin (**90**). The leaves contain two acids but no alkaloids, glucosides or tannins (**91**).	The plant is poisonous to fish.
127. **Pogostemon heyneanus** Benth. (Syn. **P. patchouli** Hook *f.* in Fl. Brit. Ind., *non* Pellet.)	A strongly aromatic herb found in Western Ghats from South Kanara southwards, in open forest land; often cultivated and then run wild. Also about Kotagiri in the Nilgiris at 6,000 ft. Sometimes cultivated in gardens in the Bombay and Bengal Presidencies.	Essential oil.	The dried leaves are extensively employed for scenting linen and other clothes and to keep off insects from shawls, etc.
128. **Polygonum flaccidum** Meissn.	Common throughout India in wet places, ascending the Himalayas to 4,000 ft., and extending to Ceylon.	......	It is locally used in Assam as a vermicide and as a fish poison. The greenish mucilaginous juice of the plant kills off mosquito larvae in 15 minutes, but it is not lethal in dilutions (**124**).
129. **Polygonum hydropiper** Linn.	A rather robust annual found in damp places more or less throughout India up to 7,000 ft. in the Himalayas.	The herb contains formic acid, acetic acid and baldrianic acid, much tannin and small amounts of an essential oil (**92**).	It is stated that insects avoid this plant; when dried and strewn among clothes it prevents the attacks of moths. The authors

NAME OF PLANT	DISTRIBUTION	CONSTITUENTS	REMARKS
120. **Ougeinia dalbergioides** Benth.	A small or medium-sized tree found in the Sub-Himalayan tracts and outer Himalayan valleys and slopes up to an altitude of 5,000 ft. from the Punjab to Bhutan; also in Oudh, Bundelkhand, Chota Nagpur, Central India, Orissa, the Circars, the Central Provinces, Bombay, and Marwar of Rajputana.	......	The bark is employed to poison fish. The stem-bark and leaf are stated to be toxic to some caterpillar pests (**56**).
121. **Pachygone ovata** (Poir.) Miers *ex* Hook. *f.* & Thoms.	A lofty climber found in the sandy seashores of the Coromandel Coast from Nellore to Tanjore and Tinnevelly; also in the Deccan in Bellary, Cuddapah and Mysore.	......	The dried fruit is used for the purpose of destroying vermin and stupefying fish (**16**). Pammel (**17**) also records it as a fish poison.
122. **Peganum harmala** Linn.	A densely foliaged bushy herb, common in the drier waste places and fields of Baluchistan, Waziristan, Kurrum Valley, Sind, Cutch, the Punjab, Kashmir, Delhi, United Provinces, Bihar, Konkan and the Western Deccan.	Seeds contain the alkaloids harmine, harmaline, harmalol and peganine (**86**); also a soft resin (**21**).	The smoke of the plant is commonly used in the Punjab as a disinfectant-fumigant, and is believed to keep off mosquitoes. According to Watt (**21**), the powdered root, mixed with mustard oil, is applied to the hair to destroy vermin.
123. **Phyllanthus urinaria** Linn.	An annual or rarely perennial herb found throughout the plains of India from the Punjab to Assam and Madras Presidency up to an altitude of 3,000 ft.	The plant is said to contain a neutral bitter substance and an alkaloidal principle (**26**).	Pammel (**17**) records the plant as a fish poison.
124. **Picrasma javanica** Blume, var. **nepalensis** (Benn.) Badhwar *nov. comb.* (Syn. **P. nepalensis** Benn.)	A moderate-sized tree found in Assam and Nepal.	......	We are informed that the powdered young leaves and the twigs of this plant are used as a larvicide in Assam.

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117. **Nicotiana tabacum** Linn.	An erect herb cultivated throughout India; sometimes met with as an escape.	Leaves, stems and roots contain volatile alkaloid, nicotine. Leaves also contain several other alkaloids (**86**), and two glucosides (**87**).	Preparations from the leaves and crude solutions of nicotine are extensively employed as insecticides in horticulture by dusting or spraying or by vaporization. Similar preparations are sometimes used for external application and as parasiticides in veterinary practice. Tobacco leaves are also used to ward off leeches, for which purpose they are placed under the stockings during marches in damp forest localities that are infested with these pests.
118. **Nigella sativa** Linn.	A pretty herb extensively cultivated in many parts of India for its seeds.	Seeds stated to contain 0·5 to 1·4 per cent of an essential oil and a saponin-like glucoside, melanthin.	It appears to be a common practice in India to scatter the seeds between the folds of linen or woollen clothes to prevent them from being eaten by insects.
119. **Ocimum gratissimum** Linn.	Cultivated in gardens throughout Bengal, East Nepal and the Deccan Peninsula; said to be a common wild plant in Western India.	Essential oil, thymol, eugenol, methyl chavicol (**18**).	The shrubby basil is popularly believed to be a good mosquito repellent and its plantation has been suggested as a measure of biological control of mosquitoes; it diffuses a stronger fragrance than any other member of the genus *Ocimum*. In this connection it may be remarked that *O. sanctum* Linn. is also believed to have similar properties.

Name of Plant	Distribution	Constituents	Remarks
113. **Mandulea sericea** (Willd.) Greenway (Syn. **M. suberosa** Benth.)—(*continued.*)			driving them away from the river. He also states that the people of Tanganyika sometimes tie the strips of bark round the legs of the cattle, when they are taken to the river to water, in order to protect them from these reptiles. It is very likely that the root is also poisonous to fish. The bark is stated to be almost as toxic to various insects as the roots of *Derris elliptica*, in spite of the low content of rotenone (**84**).
114. **Myrica nagi** Thunb.	A small evergreen dioecious tree found in the outer Himalayas from the Ravi eastwards at altitudes of 3,000 to 6,000 ft.; also in the Khasia Hills and Sylhet.	According to Hooper, 100 parts of the 'kino' produced by the bark contain about 60 to 80 parts of tannin (**20**).	According to Gamble (**85**), the bark is used in the Khasia Hills to poison fishes.
115. **Nicandra physaloides** Gaertn.	An erect annual herb introduced from Peru, but now found as a weed on rich soils in many parts of India up to 7,000 ft. on the Himalayas; often grown in gardens.	......	In Madagascar, a decoction of the leaf is stated to be used to destroy *Pediculus capitis* (**16**). It is also stated to be used as a fly poison in parts of the United States of America (**17**).
116. **Nicotiana rustica** Linn.	An erect herb cultivated in Western Punjab, Baluchistan, Bengal and other places in India, but sparingly as compared with *N. tabacum*.	See *N. tabacum*.	Properties similar to *N. tabacum*.

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116. **Nicotiana rustica** Linn.	An erect herb cultivated in Western Punjab, Baluchistan, Bengal and other places in India, but sparingly as compared with *N. tabacum*.	See *N. tabacum*.	Properties similar to *N. tabacum*.

117. **Nicotiana tabacum** Linn.	An erect herb cultivated throughout India; sometimes met with as an escape.	Leaves, stems and roots contain volatile alkaloid, nicotine. Leaves also contain several other alkaloids (**86**), and two glucosides (**87**).	Preparations from the leaves and crude solutions of nicotine are extensively employed as insecticides in horticulture by dusting or spraying or by vaporization. Similar preparations are sometimes used for external application and as parasiticides in veterinary practice. Tobacco leaves are also used to ward off leeches, for which purpose they are placed under the stockings during marches in damp forest localities that are infested with these pests.
118. **Nigella sativa** Linn.	A pretty herb extensively cultivated in many parts of India for its seeds.	Seeds stated to contain 0·5 to 1·4 per cent of an essential oil and a saponin-like glucoside, melanthin.	It appears to be a common practice in India to scatter the seeds between the folds of linen or woollen clothes to prevent them from being eaten by insects.
119. **Ocimum gratissimum** Linn.	Cultivated in gardens throughout Bengal, East Nepal and the Deccan Peninsula; said to be a common wild plant in Western India.	Essential oil, thymol, eugenol, methyl chavicol (**18**).	The shrubby basil is popularly believed to be a good mosquito repellent and its plantation has been suggested as a measure of biological control of mosquitoes, it diffuses a stronger fragrance than any other member of the genus *Ocimum*. In this connection it may be remarked that *O. sanctum* Linn. is also believed to have similar properties.

109. **Melodinus monogynus** Roxb.	A tall climber found in the Sikkim Himalayas, Assam, Sylhet and the Khasia Hills, ascending to an altitude of 4,000 ft.	......	Roxburgh, while steeping some of the young shoots in a fish pond in order to accelerate the removal of the bark and to clean the fibre, found that many it not all the fish were killed, hence his name ***Nerium piscidium*** for the plant.
110. **Millettia auriculata** Baker *ex* Brand.	A large robust woody climber, common in the outer Himalayas from Sutlej eastwards to Sikkim up to 3,500 ft. Abundant in the forest tracts of Dehra Dun, the Siwalik range, Rohilkhand, North Oudh, Gorakhpur, and Bundelkhand; also in Bihar, Orissa and Bengal, and in the forests of Ganjam and Vizagapatam up to 4,000 ft.	......	The powdered root applied to sores in cattle to kill vermin; also used to poison fishes (**21**).
111. **Millettia pachycarpa** Benth.	A large climber found in the forests of Garo and Khasia Hills, Sikkim and Assam up to an altitude of 4,000 ft.	The plant contains a large amount of saponin and possibly also considerable quantities of rotenone.	Known as 'fish poisoning vine' in China, the root being commonly used for this purpose. Mixtures of this plant with soap or tea oil serve not only as a good insecticide but also as contact and stomach poisons, the efficiency for the latter purposes being not inferior to that of derris (**82**).
112. **Millettia piscidia** Wight & Arn.	Found in Sikkim and Assam.	......	As the name suggests, it is very likely to be poisonous to fish.
113. **Mundulea sericea** (Willd.) Greenway (Syn. **M. suberosa** Benth.)	A stout shrub or small tree found in Western and Southern India in Konkan, the Circars, the Deccan asts Carnatic to Tinnevelly, in dry forend on rocky hills and up to 4,000 ft. above sea level.	According to Pammel (**17**), the bark and the root contain a very toxic glucoside but we have not been able to verify this. The bark is reported to contain only 0·8 to 0·9 per cent of rotenone.	The seeds are used for poisoning fish in Southern and Western India; the bark also possesses piscicidal properties. According to Greenway (**83**), the plant is stated to be poisonous to crocodiles and to have the effect of

Name of Plant	Distribution	Constituents	Remarks
104. **Linostoma decandrum** Wall.	An erect evergreen shrub found in Sylhet and Chittagong.	......	According to Rodger (**79**), fish poisons are made from the pulped up fruits and stems of this plant.
105. **Madhuca latifolia** (Roxb.) Macbride (Syn. **Bassia latifolia** Roxb.)	A large deciduous tree found in Oudh, Bihar, Central Provinces, Central India, Gujerat, Konkan, North Kanara, Southern Mahratta Country and the Deccan. Largely planted elsewhere and liable to run wild.	The seeds contain a neutral saponin (**80**). Leaves contain a glucosidic saponin and traces of an alkaloid (**81**).	The smoke produced during the burning of the oil cake is reported to kill insects. The oil cake used as a worm killer for lawns—4 oz. per sq. yd. (**50**). The residual cake, 'mowrah meal', after the extraction of the oil from the seeds is said to be used to poison fish.
106. **Madhuca longifolia** (Linn.) Macbride (Syn. **Bassia longifolia** Linn.)	A large tree found in the forests of Western India from Konkan southwards to Travancore; common in Malabar, Mysore, Anamalais and the Circars at low elevations.	After extraction of the oil from seeds, a sapo-glucoside called mowrin is obtained from the residue.	The residual cake 'mowrah meal' after the extraction of the oil from the seeds, is used as a worm killer for lawns as in the case of *M. latifolia* (**50**). It is also said to be used to poison fish.
107. **Maesa indica** Wall.	A large shrub found throughout India up to an altitude of 6,000 ft.; common in the North-East Himalayas, Eastern Bengal, Darjeeling district, Manipur, Kanara and along the Ghats.	......	Leaves used as a fish poison in Kanara (**21**).
108. **Melaleuca leucadendron** Linn.	An evergreen tree found in Tenasserim, Mergui, Malacca, Malay Islands and Australia. Var. *leucadendron* Duthie is cultivated in India.	Essential oil, known as cajuput oil, distilled from the leaves and twigs.	Cajuput oil is an excellent mosquito repellent and has the advantage over oil of citronella in that it volatilizes more slowly.

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	also found in a semi-wild condition in the vicinity of villages.	contain a toxalbumin known as curcin (**78**), which is a blood poison.	
99. **Juglans regia** Linn.	The walnut tree is found in the temperate Himalayas and Western Tibet at altitudes of 3,000 to 10,000 ft., both wild and under cultivation. It is cultivated in the inner valleys of Kagan, Kashmir, Chamba, Kulu and Bushahr.	The plant contains essential oil, tannins and a hydroxy-napthaquinone derivative (**20**, **76**).	According to Kanjilal (**77**), the rind of the unripe walnut fruit is used in Jaunsar and Tehri Garhwal to intoxicate fish. The authors have never heard of this very well-known plant being put to such use in other parts of the North-West Himalayas.
100. **Kalanchoe spathulata** (Poir.) DC.	A succulent perennial found in the tropical and subtropical Himalayas from Kashmir to Bhutan generally between 1,000 to 4,000 ft.; near Simla ascends to 6,000 ft.	......	The leaves are stated to be poisonous to insects.
101. **Lagenandra toxicaria** Dalz. [Many authors view this species as synonymous with **L. ovata** (Linn.) Thw. of Ceylon].	A herb found in marshes and along watercourses, often growing gregariously in Konkan, Southern Mahratta Country, North Kanara, Mysore, Coorg, and throughout the West Coast and Ghats of the Madras Presidency up to 4,000 ft.	Acrid juice.	Plant said to have insecticidal properties (**16**).
102. **Lasiosiphon eriocephalus** Decne.	A shrub found in the open forests of the Western Ghats of the Bombay and Madras Presidencies, ascending to an altitude of 7,000 ft. in the Nilgiris.	......	The bark and the leaves are frequently used for poisoning fish.
103. **Lepidium draba** Linn.	A weed of cultivation in the Punjab.	The seeds yield an essential oil, containing sulphur compounds. The young leaves yield hydrocyanic acid (**20**).	The plant is stated to be a fish poison (**17**).

Name of Plant	Distribution	Constituents	Remarks
95. **Hydnocarpus kurzii** (King) Warb. (Syn. **Taraktongenos kurzii** King)	A tree common in the evergreen forests of Upper Assam and Chittagong.	Fresh seeds contain hydrocyanic acid, the yield being about 0·036 per cent of the kernels. They also contain a fatty oil to the extent of about 38 per cent of the entire seeds; this oil consists of the glycerides of chaulmoogric acid, hydnocarpic acid and their lower homologues together with some palmitic acid (**73**). Other acids, such as taraktogenic acid, *iso*gadoleic acid and probably arachidic acid, are also present (**74**).	The hill tribes in Sikkim use the pulp of the fruit to poison fish.
96. **Hydnocarpus laurifolia** (Dennst.) Sleumer (Syn. **H. wightiana** Blume)	A tree common in the Western Peninsula; endemic in tropical forests along the Western Ghats from the Konkan southwards and below the Ghats in Kanara and Malabar, in damp situations especially near water. In Travancore it is common up to an altitude of 2,000 ft.	Seeds contain about 44 per cent of an oil (**21**), which consists of the glyceryl esters of chaulmoogric acid, hydnocarpic acid and some of their lower homologues. They have not been found to contain any cyanogenetic compounds (**75**).	Fruit reported as poisonous to fishes.
97. **Hydroeotyle javanica** Thunb.	A creeping herb with erect flexuose branches, found from Kashmir to Bhutan at altitudes of 2,000 to 8,000 ft; in the Khasia mountains between 2,000 to 6,000 ft.; and in the mountains of the Western Ghats and the Nilgiris and Pulneys, in shady places.	......	Referred to as a fish poison by Pammel (**17**), but no such use is reported in India.
98. **Jatropha curcas** Linn.	A shrub or small tree which is a native of America, grown in various parts of India as a field barrier. It is	Seeds contain 20 to 40 per cent of a fixed oil which is a drastic purgative. They also	According to Pammel (**17**), the plant is poisonous to fishes.

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98. **Jatropha curcas** Linn.	A shrub or small tree which is a native of America, grown in various parts of India as a field barrier. It is also found in a semi-wild condition in the vicinity of villages.	Seeds contain 20 to 40 per cent of a fixed oil which is a drastic purgative. They also contain a toxalbumin known as curcin (**78**), which is a blood poison.	According to Pammel (**17**), the plant is poisonous to fishes.
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102. **Lasiosiphon eriocephalus** Decne.	A shrub found in the open forests of the Western Ghats of the Bombay and Madras Presidencies, ascending to an altitude of 7,000 ft. in the Nilgiris.	......	The bark and the leaves are frequently used for poisoning fish.
103. **Lepidium draba** Linn.	A weed of cultivation in the Punjab.	The seeds yield an essential oil, containing sulphur compounds. The young leaves yield hydrocyanic acid (**20**).	The plant is stated to be a fish poison (**17**).

90. **Gnetum scandens** Roxb.	A lofty dioecious climber found in the tropical Eastern Himalayas from Sikkim eastwards to Assam and the Khasia Hills, and through Chittagong, Chota Nagpur and Bihar to the Andamans. In Western India it extends from Konkan southwards to the Ghats of both sides of the Madras Presidency at altitudes of 500 to 5,000 ft.	......	According to Pammel (**17**), the plant is used as a fish poison.
91. **Gynandropsis gynandra** (Linn.) Merr. (Syn. **G. pentaphylla** DC.)	Strong-smelling somewhat foetid herb, abundant throughout the warmer parts of India.	An acrid volatile oil (**26**).	The seeds, rubbed with oil, are used to destroy head lice.
92. **Gynocardia odorata** R. Br.	A glabrous tree common in the evergreen forests of Sikkim and Assam, extending eastwards across Chittagong as far as Tenasserim.	The seeds freed from the shell yield about 65 per cent of a fatty oil known as gynocardia oil, which does not contain chaulmoogric acid or its homologues but consists of glycerides of linolic, palmitic, linolenic, *iso*linolenic and oleic acids. They also contain a cyanogenetic glucoside, gynocardin—5 per cent of shell-free seeds (**68, 69**).	The seed pulp is employed in Sikkim to poison fish.
93. **Harpullia cupanioides** Roxb.	A small tree found in the hill tracts near Chittagong.	Saponins (**20**).	Pammel (**17**) records it as a fish poison.
94. **Hedera helix** Linn.	An evergreen climbing shrub found in the Himalayas from 6,000 to 10,000 ft., and in the Khasia Hills at 4,000 to 6,000 ft.	Nearly all parts of the plant contain the glucoside α-hederin and probably other glucosides (**70, 71**). Leaves also contain a saponin which is closely related to α-hederin (**72**).	A decoction of the leaves said to be applied externally in some places to destroy vermin in the heads of children (**21**).

Name of Plant	Distribution	Constituents	Remarks
85. **Fluggea leucopyrus** (Koen.) Willd.	A large rigid bushy shrub found in the Sub-Himalayan tracts of Kheri (North Oudh), and Gorakhpur, outer ranges of the Kumaon Himalayas up to 5,000 ft., in the Punjab plains, Sind, and throughout Bombay and Madras Presidencies usually in open places.	The bark contains about 10 per cent of tannins (**26**).	The bark is stated to be used as a fish poison.
86. **Fluggea virosa** (Roxb. *ex* Willd.) Baill. (Syn. **F. microcarpa** Blume)	A large unarmed shrub or small tree found throughout India, from the Indus and Kashmir eastwards to Assam in the Himalayas up to an altitude of 5,000 ft., and in the rest of India in deciduous forests.	The bark contains about 8.9 per cent of tannins (**26**).	The bark is stated to be used as a fish poison.
87. **Gardenia campanulata** Roxb.	A shrub found at the foot of the Sikkim Himalayas, Assam, Sylhet, Chittagong and at the summit of Parasnath in Bihar.	Saponin (**124**).	The fruit is used as a fish poison, and the fruit juice is an efficient larvicide in dilutions up to 1 in 80 (**124**).
88. **Gaultheria fragrantissima** Wall.	A stout herb met with from Nepal to Bhutan at 6,000 to 8,000 ft.; also on the Khasia Hills, Western Ghats, the Nilgiris, the Pulneys and hills of Travancore at altitudes over 5,000 ft.	Essential oil in leaves and other parts of the plant (**18, 65**).	Essential oil a constituent of several insecticidal and insect-repellent preparations.
89. **Gloriosa superba** Linn.	A tall herbaceous climber found throughout tropical India up to 7,000 ft. on the hills; common in Mysore State.	Rootstock contains a toxic bitter principle, alkaloid colchicine, and two other bases (**66, 67**).	Juice of the leaves used in Guiana to destroy lice in the hair (**16**).

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90. **Gnetum scandens** Roxb.	A lofty dioecious climber found in the tropical Eastern Himalayas from Sikkim eastwards to Assam and the Khasia Hills, and through Chittagong, Chota Nagpur and Bihar to the Andamans. In Western India it extends from Konkan southwards to the Ghats of both sides of the Madras Presidency at altitudes of 500 to 5,000 ft.	......	According to Pammel (**17**), the plant is used as a fish poison.
91. **Gynandropsis gynandra** (Linn.) Merr. (Syn. **G. pentaphylla** DC.)	Strong-smelling somewhat foetid herb, abundant throughout the warmer parts of India.	An acrid volatile oil (**26**).	The seeds, rubbed with oil, are used to destroy head lice.
92. **Gynocardia odorata** R. Br.	A glabrous tree common in the evergreen forests of Sikkim and Assam, extending eastwards across Chittagong as far as Tenasserim.	The seeds freed from the shell yield about 65 per cent of a fatty oil known as gynocardia oil, which does not contain chaulmoogric acid or its homologues but consists of glycerides of linolic, palmitic, linolenic, *iso*linolenic and oleic acids. They also contain a cyanogenetic glucoside, gynocardin—5 per cent of shell-free seeds (**68, 69**).	The seed pulp is employed in Sikkim to poison fish.
93. **Harpullia cupanioides** Roxb.	A small tree found in the hill tracts near Chittagong.	Saponins (**20**).	Pammel (**17**) records it as a fish poison.
94. **Hedera helix** Linn.	An evergreen climbing shrub found in the Himalayas from 6,000 to 10,000 ft., and in the Khasia Hills at 4,000 to 6,000 ft.	Nearly all parts of the plant contain the glucoside α-hederin and probably other glucosides (**70, 71**). Leaves also contain a saponin which is closely related to α-hederin (**72**).	A decoction of the leaves said to be applied externally in some places to destroy vermin in the heads of children (**21**).

	ous leaves. Found in dry places throughout the hotter parts of India up to 2,000 ft. Occasionally cultivated as a hedge plant in villages.		Juice also used by the Mundas of Chota Nagpur to stupefy and catch fish (**16**).
80. **Euphorbia neriifolia** Linn.	A large fleshy shrub or small tree occasionally planted in villages as a hedge plant throughout India and is sometimes found to run wild on waste-land. In Orissa and in the Deccan it is said to occur in a state of nature in rocky places.	......	According to Pammel (**17**), the plant is a fish poison.
81. **Euphorbia royleana** Boiss.	A glabrous fleshy shrub or small tree common on the dry and hot rocky slopes of the outer ranges of the Western Himalayas from the Indus to Kumaon, ascending to an altitude of 6,000 ft. ; also on the Salt Range in the Punjab. It is commonly grown in hedges in the Sub-Himalayan tract and the adjacent plains.	......	Pammel (**17**) records the plant as a fish poison.
82. **Euphorbia thymifolia** Linn.	A small prostrate annual found throughout the greater part of India, up to 4,000 ft. on the Himalayas.	Essential oil.	Essential oil used in sprays to keep off flies and mosquitoes from inhabited rooms (**64**).
83. **Euphorbia tirucalli** Linn.	An unarmed shrub or small tree which is a native of Africa and has become naturalized in several places in India. It is often grown as a hedge or occasionally as a roadside tree.	The milky juice contains about 20 per cent of resins (**20**).	Used as a fish poison in the Southern Mahratta Country.
84. **Excoecaria agallocha** Linn.	A small evergreen tree found in tidal forests and swamps on all the coasts of India.	......	Pammel (**17**) records the plant as a fish poison.

Name of Plant	Distribution	Constituents	Remarks
74. **Entada pursaetha** DC. (Syn. **E. scandens** Benth.)—(*continued*)	especially in damp forests situated at higher altitudes; also in the forests along the Ghats of the Bombay Presidency. In the Madras Presidency it is found in the hill forests of the Northern Circars, the Deccan and on the Western Ghats from South Kanara to Travancore in evergreen forests.	The bark and the wood contain toxic saponins but these are absent in the leaves (**63**).	'the juice of the leaves is employed in Ceylon for stupefying fish'.
75. **Eremostachys superba** Royle *ex* Benth.	An erect herb which has been reported from Garhwal in the Western Himalayas and from Peshawar in the North-West Frontier Province.	......	Pammel (**17**) records the plant as poisonous to fish.
76. **Eremostachys vicaryi** Benth.	An erect herb common on the Salt Range, ascending up to 2,500 ft.; it is also met with in and near Peshawar and in Baluchistan.	......	The plant is employed as a fish poison in the Eusafzai country near Peshawar (**21**).
77. **Eucalyptus globulus** Labill.	A gigantic tree of Australia and Tasmania. Introduction into India; a complete success in the Nilgiris. Does not thrive in the plains nor on the outer Himalayan ranges.	Essential oil.	Eucalyptus oil obtained from the leaves is largely used as a mosquito and vermin repellent and is an important constituent of many insecticidal and insect-repellent preparations.
78. **Eupatorium odoratum** Linn.	An obnoxious weed introduced from the West Indies; covers extensive areas in Bengal and Assam.	......	Recorded as poisonous to fishes.
79. **Euphorbia antiquorum** Linn.	A fleshy much-branched large shrub or small tree with a few decidu-	Acrid milky juice.	Milky juice used to kill maggots in wounds.

NAME OF PLANT	DISTRIBUTION	CONSTITUENTS	REMARKS
74. **Entada pursaetha** DC. (Syn. E. **scandens** Benth.)—(*continued*)	especially in damp forests situated at higher altitudes; also in the forests along the Ghats of the Bombay Presidency. In the Madras Presidency it is found in the hill forests of the Northern Circars, the Deccan and on the Western Ghats from South Kanara to Travancore in evergreen forests.	The bark and the wood contain toxic saponins but these are absent in the leaves (**63**).	'the juice of the leaves is employed in Ceylon for stupefying fish'.
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78. **Eupatorium odoratum** Linn.	An obnoxious weed introduced from the West Indies; covers extensive areas in Bengal and Assam.	......	Recorded as poisonous to fishes.
79. **Euphorbia antiquorum** Linn.	A fleshy much-branched large shrub or small tree with a few deciduous leaves. Found in dry places throughout the hotter parts of India up to 2,000 ft. Occasionally cultivated as a hedge plant in villages.	Acrid milky juice.	Milky juice used to kill maggots in wounds. Juice also used by the Mundas of Chota Nagpur to stupefy and catch fish (**16**).
80. **Euphorbia nerifolia** Linn.	A large fleshy shrub or small tree occasionally planted in villages as a hedge plant throughout India and is sometimes found to run wild on waste-land. In Orissa and in the Deccan it is said to occur in a state of nature in rocky places.	......	According to Pammel (**17**), the plant is a fish poison.
81. **Euphorbia royleana** Boiss.	A glabrous fleshy shrub or small tree common on the dry and hot rocky slopes of the outer ranges of the Western Himalayas from the Indus to Kumaon, ascending to an altitude of 6,000 ft.; also on the Salt Range in the Punjab. It is commonly grown in hedges in the Sub-Himalayan tract and the adjacent plains.	......	Pammel (**17**) records the plant as a fish poison.
82. **Euphorbia thymifolia** Linn.	A small prostrate annual found throughout the greater part of India, up to 4,000 ft. on the Himalayas.	Essential oil.	Essential oil used in sprays to keep off flies and mosquitoes from inhabited rooms (**64**).
83. **Euphorbia tirucalli** Linn.	An unarmed shrub or small tree which is a native of Africa and has become naturalized in several places in India. It is often grown as a hedge or occasionally as a roadside tree.	The milky juice contains about 20 per cent of resins (**20**).	Used as a fish poison in the Southern Mahratta Country.
84. **Excoecaria agallocha** Linn.	A small evergreen tree found in tidal forests and swamps on all the coasts of India.	......	Pammel (**17**) records the plant as a fish poison.

70. **Dodonaea viscosa** (Linn.) Jacq.	An evergreen shrub, rarely a small tree, met with in the North-West Himalayas up to an altitude of 4,500 ft.; also in Sind and South India up to 8,000 ft. in the Nilgiris. Commonly planted in Northern India as a hedge plant.	The plant contains saponins (**60**).	According to Pammel (**17**), the plant is poisonous to fishes.
71. **Dolichandrone falcata** Seem.	A deciduous tree found in Rajputana, Bundelkhand, Bihar, Central Provinces, Berar, Konkan, Deccan, Mysore and most districts of the Madras Presidency in dry deciduous forests and often on rocky places.	......	The bark is used in the neighbourhood of Poona and other places as a fish poison.
72. **Duranta repens** Linn. (Syn. **D. plumieri** Jacq.)	An evergreen shrub, one of the commonest hedge plants in Indian gardens.	The leaves contain a saponin (**125**). The berries contain an alkaloid analogous to narcotine (**124**).	When macerated the berries exude a juice which is lethal to all anophelines and culicines. Manson (**124**) has found that the juice is lethal to anophelines and culicines in dilutions up to 1 in 100, but not in weaker strengths. The action on culicines is less marked than on anophelines.
73. **Edgeworthia gardneri** Meissn.	A large much-branched bush found along the Himalayas from Nepal to Sikkim and Bhutan, between 4,000 and 9,000 ft. It is also plentiful in Manipur.	......	Pammel (**17**), on the authority of Greshoff, records it as a fish poison.
74. **Entada pursaetha** DC. (Syn. **E. scandens** Benth.)	A gigantic woody climber found in the Central and Eastern Himalayas ascending to 4,000 ft. in Sikkim; also in Eastern Bengal, Bihar and Orissa	The seeds contain two toxic saponins (**61**); also said to contain a glucoside which is hydrolyzed by emulsin (**62**).	The seeds are used as a fish poison in some parts of India, South Africa and in the Philippine Islands. Watt (**21**) records that

			used as a substitute for soap on account of the large amount of saponins they contain.
142. **Sapium indicum** Willd.	An evergreen tree found in the Sundarbans, and in the West Coast along backwaters in Malabar and Travancore.	......	The seeds are employed as a fish-intoxicant by local people where the tree is found.
143. **Sarcostemma acidum** (Roxb.) Voigt (Syn. **S. brevistigma** Wight & Arn.)	Leafless, trailing or twining, jointed shrub usually found on arid rocks in Konkan, the Deccan, Northern Circars, Carnatic and on Horsleykonda up to 4,500 ft. Also reported from Ranchi (Horhap forest), Singhbum and Puri. Occurs in Bengal also.	......	Often used by farmers to extirpate white ants from sugarcane fields. A bundle of twigs is put into the trough of the well from which the field is watered, along with a bag of salt, hard packed, so that it may dissolve gradually. The water so impregnated has been stated to destroy the ants without injuring the crop (**21**). Three other Indian species of this genus, which are almost indistinguishable in a dry state from this plant, are similarly used. Two of them, *S. brunonianum* Wight & Arn. and *S. intermedium* Decne., are inhabitants of Western and Southern India. The third *S. stocksii* Hook. *f.* is found in Sind and Southern Mahratta Country and is more robust than any of the other three. These are known by the same vernacular names as *S. acidum*.

Name of Plant	Distribution	Constituents	Remarks
144. **Saussurea lappa** C.B. Clarke	A tall stout perennial herb found in Kashmir and the surrounding country.	Essential oil, alkaloid saussurine, resin, traces of a bitter substance, etc. (**100**).	The roots of costus are used in India to protect woollen fabric from insects. It is believed by Indian ladies that they do not tarnish gold embroidery on their clothing as does naphthalene.
145. **Schleichera oleosa** (Lour.) Merr. (Syn. S. **trijuga** Willd.)	A large tree found in dry forests of the Sub-Himalayan tracts, from the Sutlej eastwards and throughout Central and Southern India.	Seeds contain a fixed oil and small quantities of a cyanogenetic compound (**101, 102**).	The powdered seeds are applied to ulcers in animals for removing maggots.
146. **Scleria pergracilis** (Nees) Kunth	Widely scattered from Garhwal at an altitude of 5,000 ft. to Assam, Bihar, Chota Nagpur and the Deccan.	......	The lemon-scented leaves are used to drive away mosquitoes (**103**).
147 **Sophora mollis** R. Grah.	A low shrub found in the Himalayas and Sub-Himalayan tracts of North-Western India from Gilgit, Chitral, Hazara and the Salt Range to Knmaon and Nepal up to 7,000 ft. Locally common near Malakand, in Kagan and Kilba, Bushahr and Sahansradhara near Dehra Dun.	An alkaloid, sophorine, which is identical with cytisine has been isolated from *S. tomentosa* Linn. found in the Andaman and Nicobar Islands, and also occasionally cultivated in Indian gardens. This alkaloid has insecticidal properties although the use of the plant as an insecticide is not recorded. It is likely that *S. mollis* contains similar or identical alkaloid.	The seeds are stated to be useful for destroying vermin (**16**).
148. **Sphaeranthus indicus** Linn.	A strongly scented herb found throughout India, especially in damp places and in cultivated fields after harvest, ascending in the Himalayas up to an altitude of 5,000 ft. from Kumaon to Sikkim.	The herb contains 0·22 per cent of an essential oil (**104**); it is also stated to contain a bitter alkaloid (**26**).	The Mundas of Chota Nagpur bruise the whole plant and throw it into water to kill fish. It is also stuffed into crabs' holes to kill them.

149. **Stephania hernandiifolia** (Willd.) Walp.	A slender twining shrub found on the West and East Coast, Cachar, Sikkim, East Bengal and Assam.	Probably contains saponins (**105**).	The extract acts as a strong poison to frogs (**16**).
150. **Strychnos colubrina** Linn.	A large climbing shrub found in Western and Southern parts of India in Bombay, Konkan, Poona, Kanara, Carnatic, Veligonda Hills of Nellore, Western Coast from South Kanara to Travancore to the lower forests of the Western Ghats.	The roots, seeds, bark and wood contain the alkaloids brucine and strychnine (**20**).	The seeds are likely to be poisonous to fishes.
151. **Strychnos nux-vomica** Linn.	A deciduous tree found in the forests of Gorakhpur, Bihar and Orissa, Konkan, North Kanara, Southern Mahratta Country, Northern Circars, the Deccan and Carnatic; also on the West Coast of the Madras Presidency in deciduous forests and up to 4,000 ft. in hilly country.	Strychnine is the most important alkaloid contained in this plant; besides this there are present brucine and others. These compounds exist not only in the seeds, the most important part of the plant, but also in the root, wood, bark, leaves, fruit pulp, etc. The seeds also contain the glucoside loganin (**20**).	Watt (**21**) states that the seeds are used by the hill tribes of Nilgiris as a fish poison.
152. **Taxus baccata** Linn.	A small or medium-sized evergreen tree met with in the temperate Himalayas at altitudes of 6,000 to 11,000 ft., and in the Khasia Hills at altitudes of 5,000 ft.	The leaves, shoots, and fruits contain a toxic alkaloid, taxine (**86**). According to Lander (**106**), the sap contains a volatile oil. Blyth (**107**) states that the leaves contain much formic acid. The leaves also contain the glucoside taxicatin (**108**), and small amounts of ephedrine (**109**),	Pammel (**17**) records the plant as a fish poison.

Name of Plant	Distribution	Constituents	Remarks
144. **Saussurea lappa** C.B. Clarke	A tall stout perennial herb found in Kashmir and the surrounding country.	Essential oil, alkaloid saussurine, resin, traces of a bitter substance, etc. (**100**).	The roots of costus are used in India to protect woollen fabric from insects. It is believed by Indian ladies that they do not tarnish gold embroidery on their clothing as does naphthalene.
145. **Schleichera oleosa** (Lour.) Merr. (Syn. S. **trijuga** Willd.)	A large tree found in dry forests of the Sub-Himalayan tracts, from the Sutlej eastwards and throughout Central and Southern India.	Seeds contain a fixed oil and small quantities of a cyanogenetic compound (**101, 102**).	The powdered seeds are applied to ulcers in animals for removing maggots.
146. **Scleria pergracilis** (Nees) Kunth	Widely scattered from Garhwal at an altitude of 5,000 ft. to Assam, Bihar, Chota Nagpur and the Deccan.	......	The lemon-scented leaves are used to drive away mosquitoes (**103**).
147 **Sophora mollis** R. Grah.	A low shrub found in the Himalayas and Sub-Himalayan tracts of North-Western India from Gilgit, Chitral, Hazara and the Salt Range to Kumaon and Nepal up to 7,000 ft. Locally common near Malakand, in Kagan and Kilba, Bushahr and Sahansradhara near Dehra Dun.	An alkaloid, sophorine, which is identical with cytisine has been isolated from *S. tomentosa* Linn. found in the Andaman and Nicobar Islands, and also occasionally cultivated in Indian gardens. This alkaloid has insecticidal properties although the use of the plant as an insecticide is not recorded. It is likely that *S. mollis* contains similar or identical alkaloid.	The seeds are stated to be useful for destroying vermin (**16**).
148. **Sphaeranthus indicus** Linn.	A strongly scented herb found throughout India, especially in damp places and in cultivated fields after harvest, ascending in the Himalayas up to an altitude of 5,000 ft. from Kumaon to Sikkim.	The herb contains 0·22 per cent of an essential oil (**104**); it is also stated to contain a bitter alkaloid (**26**).	The Mundas of Chota Nagpur bruise the whole plant and throw it into water to kill fish. It is also stuffed into crabs' holes to kill them.

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152. **Taxus baccata** Linn.	A small or medium-sized evergreen tree met with in the temperate Himalayas at altitudes of 6,000 to 11,000 ft., and in the Khasia Hills at altitudes of 5,000 ft.	The leaves, shoots, and fruits contain a toxic alkaloid, taxine (**86**). According to Lander (**106**), the sap contains a volatile oil. Blyth (**107**) states that the leaves contain much formic acid. The leaves also contain the glucoside taxicatin (**108**), and small amounts of ephedrine (**109**),	Pammel (**17**) records the plant as a fish poison.

Name of Plant	Distribution	Constituents	Remarks
153. **Tephrosia candida** (Roxb.) DC.	A weak shrub found in the tropical Himalayas from Garhwal to Khasia and Assam, ascending up to an altitude of 5,000 ft. in Sikkim; in Chittagong and the Sameshwar hills. It is occasionally grown as an ornamental plant.	......	The plant has been recorded by Gamble (**85**) as a fish poison in Eastern Bengal and Burma; the bark and leaves are chiefly used for this purpose. An extract (**56**) of the seeds has been tested for its insecticidal properties on small-scale field trials, and found to be quite efficacious.
154. **Tephrosia purpurea** (Linn.) Pers.	A sub-erect herbaceous perennial found all over India, ascending in the Himalayas up to an altitude of 6,000 ft.	The roots contain tephrosin, deguelin, *iso*tephrosin, rotenone, etc. (**110, 111**). The leaves contain about 2 per cent of a glucoside, osyritin (**112**).	The root is used to poison fish in French Guiana, but no such use has been reported in India.
155. **Tephrosia vogelii** Hook. f.	Reported to be cultivated in Assam by tea planters as a green manure.	Leaves contain tephrosin and deguelin (**113**). Seeds contain tephrosin, deguelin, dehydrodeguelin, *allo*tephrosin and *iso*deguelin (**114, 115**).	The leaves are said to be an efficient insecticide against fleas, lice and ticks; in the dry state they are used as a flea powder. In fact, it has been suggested that the plant might be used as a commercial dip for cattle (**19**). Chopra and collaborators (**7**) have recently found that the leaves of Assam-grown plant do not possess insecticidal properties to any marked degree. Further work is necessary to find out whether the leaves possess potent insecticidal properties at any time of the

				year. It is possible that the leaves show seasonal variation. About a dozen species are found in India and some of them are commonly met with. It would be worth while investigating the insecticidal properties of these, especially of *T. candida* Linn. and *T. purpurea* Pers., which, as mentioned above, are used as fish poisons.
156.	**Terminalia bellirica** (Gaertn.) Roxb.	A large deciduous tree common in the plains and lower hills throughout India with the exception of the arid tracts in the West.	The fruits contain 5 to 17 per cent of tannin (**20**).	The plant has been reported as a fish poison (**17**), but we have never heard of such a use in India in spite of its great abundance.
157.	**Thevetia peruviana** (Pers.) Merr. (Syn. T. **nereifolia** Juss. *ex* Steud.)	Originally a native of America and West Indies, this large evergreen shrub or small tree is now almost naturalized in some places. There is scarcely a garden in the plains without a few shrubs, if not a hedge.	Chen & Chen (**116**) have extracted a fatty oil, constituting more than 62 per cent of the kernel, and four crystalline substances—a phytosterolin, ahouain, kokilphin, and thevetin. The roots have also been found to contain thevetin (**118**).	In Brazil the plant has been employed as a fish poison (**117**).
158.	**Trigonella foenum-graecum** Linn.	An aromatic annual herb found wild in Kashmir, the Punjab and the Upper Gangetic Plain; widely cultivated in many parts of India.	Alkaloid trigonelline (**18**), and essential oil.	Fenugreek is used as an insect repellent; agriculturists in the Kangra district in the Punjab mix the dried plant with the grains stored up in bags, in order to protect them from attacks of insects during rainy weather.

Name of Plant	Distribution	Constituents	Remarks
153. **Tephrosia candida** (Roxb.) DC.	A weak shrub found in the tropical Himalayas from Garhwal to Khasia and Assam, ascending up to an altitude of 5,000 ft. in Sikkim; in Chittagong and the Sameshwar hills. It is occasionally grown as an ornamental plant.	......	The plant has been recorded by Gamble (**85**) as a fish poison in Eastern Bengal and Burma; the bark and leaves are chiefly used for this purpose. An extract (**56**) of the seeds has been tested for its insecticidal properties on small-scale field trials, and found to be quite efficacious.
154. **Tephrosia purpurea** (Linn.) Pers.	A sub-erect herbaceous perennial found all over India, ascending in the Himalayas up to an altitude of 6,000 ft.	The roots contain tephrosin, deguelin, *iso*tephrosin, rotenone, etc. (**110, 111**). The leaves contain about 2 per cent of a glucoside, osyritin (**112**).	The root is used to poison fish in French Guiana, but no such use has been reported in India.
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158. **Trigonella foenum-graecum** Linn.	An aromatic annual herb found wild in Kashmir, the Punjab and the Upper Gangetic Plain; widely cultivated in many parts of India.	Alkaloid trigonelline (**18**), and essential oil.	Fenugreek is used as an insect repellent; agriculturists in the Kangra district in the Punjab mix the dried plant with the grains stored up in bags, in order to protect them from attacks of insects during rainy weather.

Name of Plant	Distribution	Constituents	Remarks
159. **Verbascum thapsus** Linn.	A stout woolly herb found in the temperate Himalayas between 5,000 to 12,000 ft., and in Western Tibet. It also occurs in the Western Ghats and in the Nilgiris in the neighbourhood of Ootacamund where it has been introduced and is now rapidly spreading.	The leaves contain an amorphous bitter substance and a saponin (**119**); the flowers a saponin and the seeds 0·37 per cent of a saponin (**120**). The roots contain a glucoside (**121**).	According to O'Shaughnessy (**21**), the seeds are used for poisoning fish. The present authors have not come across the use of the seeds as a fish poison. It is however, likely that the whole plant possesses piscicidal properties, as is apparent from its chemical composition. Pammel (**17**) also records the plant as a fish poison.
160. **Vitex negundo** Linn.	A large aromatic shrub common throughout India up to 3,000 ft. in the North-West Himalayas.	Alkaloid (**18**).	The leaves of Indian privet are laid over stored grains to keep off insects.
161. **Walsura piscidia** Roxb.	A small tree found in the Western Ghats from North Kanara to the Anamalais, Pulneys and Travancore; Northern Circars, Carnatic, the Deccan, Hazaribagh, Gaya Ghats, and in the Puri Division.	The plant is stated to contain saponins (**122**).	Roxburgh and following him many other workers state that the bark is largely employed to intoxicate fish and that fish so caught are not less wholesome to eat than ordinary fish.
162. **Wikstroemia indica** (Linn.) C. A. Mey., var. **viridiflora** (Meissn.) Hook. f.	A bushy shrub found in Chittagong.	......	The plant has been recorded by Pammel (**17**) as a fish poison.
163. **Zanthoxylum alatum** Roxb.	A shrub or small tree found in the hot valleys of the Sub-tropical Himalayas from the Trans-Indus area	The fruits contain about 1·5 per cent of an essential oil (**123**). The bark contains a bitter	According to Brandis, the bark is used for killing fish, while Atkinson reports that the

	eastwards to Bhutan up to an altitude of 7,000 ft.; also in the Khasia Hills between 2,000 and 3,000 ft., and in the hills of Ganjam and Vizagapatam at about 4,500 ft.	crystalline principle, which is identical with berberine. It also contains a volatile cil and resins (**21**).	fruit is also used for the same purpose (**21**).
164. **Zanthoxylum hamiltonianum** Wall.	A climbing thorny shrub of Sikkim and Assam.	......	The roots are used as a fish poison by cutting them into pieces and putting these in a bag which is thrown into a pond containing fish. The action is fairly rapid and the fish become stupefied and their eyes congested in about half an hour. In the laboratory a boiled fresh solution of the roots killed 100 anopheline larvae in 7 minutes. It acts equally on anophelines and culicines but has no action on pupae. The diluted juice loses its potency after 3 days and becomes inert on the 5th day (**124**).

NAME OF PLANT	DISTRIBUTION	CONSTITUENTS	REMARKS
159. **Verbascum thapsus** Linn.	A stout woolly herb found in the temperate Himalayas between 5,000 to 12,000 ft., and in Western Tibet. It also occurs in the Western Ghats and in the Nilgiris in the neighbourhood of Ootacamund where it has been introduced and is now rapidly spreading.	The leaves contain an amorphous bitter substance and a saponin (**119**); the flowers a saponin and the seeds 0·37 per cent of a saponin (**120**). The roots contain a glucoside (**121**).	According to O'Shaughnessy (**21**), the seeds are used for poisoning fish. The present authors have not come across the use of the seeds as a fish poison. It is however, likely that the whole plant possesses piscicidal properties, as is apparent from its chemical composition. Pammel (**17**) also records the plant as a fish poison.
160. **Vitex negundo** Linn.	A large aromatic shrub common throughout India up to 3,000 ft. in the North-West Himalayas	Alkaloid (**18**).	The leaves of Indian privet are laid over stored grains to keep off insects.
161. **Walsura piscidia** Roxb.	A small tree found in the Western Ghats from North Kanara to the Anamalais, Pulneys and Travancore; Northern Circars, Carnatic, the Deccan, Hazaribagh, Gaya Ghats, and in the Puri Division.	The plant is stated to contain saponins (**122**).	Roxburgh and following him many other workers state that the bark is largely employed to intoxicate fish and that fish so caught are not less wholesome to eat than ordinary fish.
162. **Wikstroemia indica** (Linn.) C. A. Mey., var. **viridiflora** (Meissn.) Hook. f.	A bushy shrub found in Chittagong.	......	The plant has been recorded by Pammel (**17**) as a fish poison.
163. **Zanthoxylum alatum** Roxb.	A shrub or small tree found in the hot valleys of the Sub-tropical Himalayas from the Trans-Indus area eastwards to Bhutan up to an altitude of 7,000 ft.; also in the Khasia Hills between 2,000 and 3,000 ft., and in the hills of Ganjam and Vizagapatam at about 4,500 ft.	The fruits contain about 1·5 per cent of an essential oil (**123**). The bark contains a bitter crystalline principle, which is identical with berberine. It also contains a volatile oil and resins (**21**).	According to Brandis, the bark is used for killing fish, while Atkinson reports that the fruit is also used for the same purpose (**21**).
164. **Zanthoxylum hamiltonianum** Wall.	A climbing thorny shrub of Sikkim and Assam.	......	The roots are used as a fish poison by cutting them into pieces and putting these in a bag which is thrown into a pond containing fish. The action is fairly rapid and the fish become stupefied and their eyes congested in about half an hour. In the laboratory a boiled fresh solution of the roots killed 100 anopheline larvae in 7 minutes. It acts equally on anophelines and culicines but has no action on pupae. The diluted juice loses its potency after 3 days and becomes inert on the 5th day (**124**).

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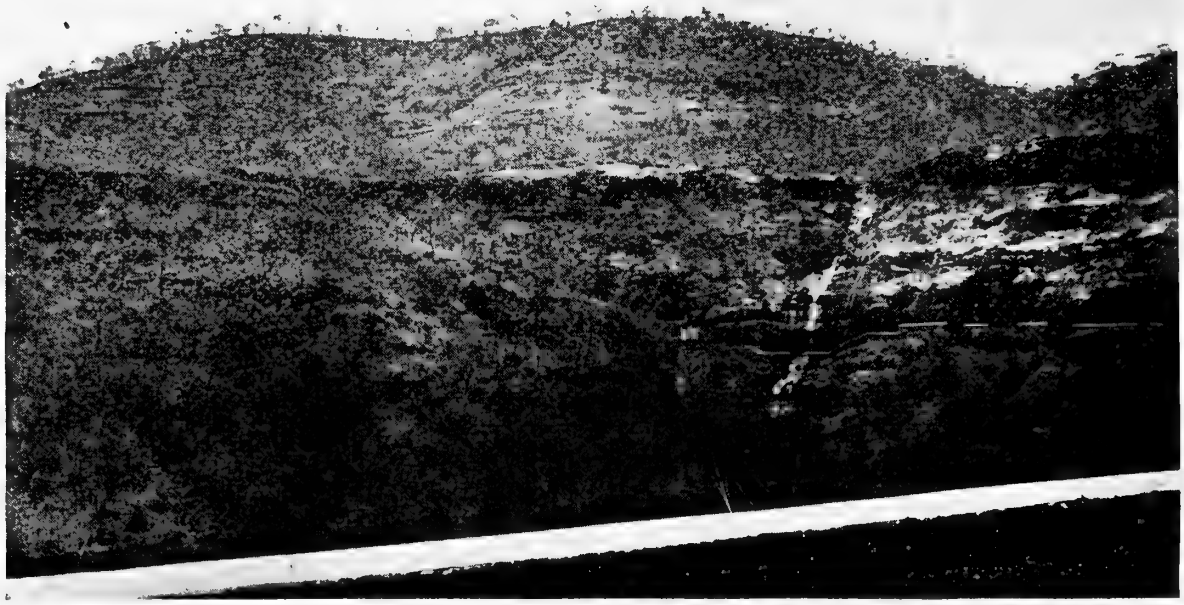

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Fig. 1.—A view of part of the Ajanta Hills where the forest is of the monsoon type.

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Fig. 2.—A thicket of *Calamus Rotang* Linn. near the Ramappa tank in Mulug.

ADDITIONS TO OUR KNOWLEDGE OF THE FLOWERING PLANTS OF H. E. H. THE NIZAM'S DOMINIONS, HYDERABAD, DECCAN.

BY

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(*With one plate*).

Dicotyledons.

It is now nearly three years since a contribution was made to the pages of this *Journal*[1]. During this period a number of collections have been made from several districts, *viz.*, Mulug, Sirnapalli, Vikarabad, Amrabad (including Mananur and Farahabad), Adilabad, and from the suburbs of Hyderabad city. This report deals with only such material as has been carefully identified, and later on compared with the type specimens at the Sibpur and Dehra Dun Herbaria. The families and species dealt with number 53 and 170 respectively.

The author is now in a position to say something about the types of forest, and the dominant species met with in the abovementioned districts. There is really no typical rain-forest in the Dominions. An intermediate form between rain- and monsoon-forest is met with, *viz.*, near Salvoy in the Mulug Talukha of Warangal District (Fig. 1), near Mananur at Pedda Omamaheshwaram, in the vicinity of Kuntala (in Both Talukha of Adilabad District), and along the Ajanta Hills (Fig. 2). The dominant species common to most of these forests are *Tectona grandis* Linn., *Olax scandens* Roxb., *Erythroxylon monogynum* Roxb., *Terminalia tomentosa* W. and A., *Balanites Roxburghii* Planch., *Buchanania latifolia* Roxb., *Semecarpus Anacardium* Linn., *Cleistanthus collinus* Benth., *Bombax malabaricum* DC., *Diospyros tomentosa* Roxb., *Diospyros Melanoxylon* Roxb., *Chloroxylon Swietenia* DC., *Phyllanthus Emblica* Linn., *Aegle Marmelos* Correa, *Strychnos potatorum* Linn., and others. *Strychnos Nux-vomica* Linn. is, however, very common in the Warangal, Karimnagar and Adilabad Districts. *Dendrocalamus strictus* Nees is common in hilly regions. *Calamus Rotang* Linn. is found only in the Warangal District in Mulug below the Ramappa tank (Fig. 3).

The second type of forest is the open-forest which is common. The dominant species in such forests are *Boswellia serrata* Roxb., *Bassia latifolia* Roxb., *Tectona grandis* Linn. of stunted growth, species of *Gardenia* and *Randia*, *Lagerstroemia parviflora* Roxb., *Anogeissus latifolia* Wall., *Feronia Elephantum* Correa, and others.

[1] 'A further contribution to some of the common flowering plants of the Hyderabad State; their distribution and economic importance—Dicotyledons.' (vol. xi, No. 2, Sept. 1938).

The last type of forest met with in the Dominions is the thorn-forest or scrub-jungle. It is common on laterite and on rocky soil. Amongst the trees, members of the Leguminosae family form gregarious patches. Species of *Zizyphus, Gardenia, Wrightia* and *Grewia, Holarrhena antidysenterica* Wall. and *Anona squamosa* Linn. are common. Amongst low shrubs *Cassia auriculata* Linn. is very wide-spread and dominant.

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I am thankful to all my colleagues, particularly Messrs. M. A. Salam and M. R. Suxena for the help rendered in connection with the collection, preservation and identification of the material. While working at the Sibpur Herbarium, Mr. Salam compared some of our collections with the type specimens there. Mr. Suxena did the same during his work at the Dehra Dun Herbarium.

I. RANUNCULACEAE.

1. **Naravelia zeylanica** DC. Syst. 1. 167; H. F. B. I., i, 7; Dalz. & Gibs. i; Trim. F. Ceyl. i, 2; Watt. Dict. Econ. Prod. I., V, 317; Talb. For. F. Bomb. Pres., I, 7, Cooke. F. Pres. Bomb., I, 4.

Habitat.—Found in moist forest on the banks of *Dayyum Murgu* near Salvoy in Mulug (Warangal District).
Flowering Season.—Nov.-Dec.

II. DILLENIACEAE.

2. **Dillenia indica** Linn. Sp. Pl. 535, H.F.B.I., i, 36; Talb. For F. Bomb. Pres., I, 10; Watt. Dict. Econ. Prod. I., iii, 113; Cooke F. Pres. Bomb., I, 6.

Syn.—*D. speciosa,* Thunb. in Trans. Linn. Soc., I (1791), 200; Dalz. & Gibs, 2; Wt. Ic., 823.
Indian Names.—Chalta, Girnar (Hindi); Motakarmal (Mar.); Kalinga, Peddakalinga (Tel.); Chalta (Beng.); Bettakanigala (Canarese); Chalita (Malayalam).
Habitat.—Cultivated in gardens.
Flowering season.—May-June.
Uses.—Medicinal (Kirtikar).

III. ANONACEAE.

3. **Saccopetalum tomentosum** H. f. & Thos. Fl. Ind. (1855); H.F.B.I., i, 88; Dalz. & Gibs., 4; Talb. For. F. Bomb. Pres., i, 31; Watt. Dict. Econ. Prod. I, VI, Pt. 2, 381; Cooke. F. Pres. Bomb., i, 16.

Habitat.—Found in the Anantgiri forest (Vikarabad).
Flowering season.—April-June, fruits in Aug.

IV. MENISPERMACEAE.

4 **Tinospora malabarica** Miers Contrib. iii (1864), 32; H.F.B.I., i, 96; Dalz. & Gibs., 5; Trim. F. Ceyl., i, 38; Talb. For. F. Bomb. Pres., i, 36; Cooke. F. Pres. Bomb., i, 18.

Syn.—*Cocculus malabaricus* DC. Syst., i, 518.
Indian Names.—Giloe, Gulancha, Gurch (Hindi); Gulvel (Mar.); Potchindil (Tam.); Padmagaluncha (Beng.).
Habitat.—Common in most forests.
Flowering season.—Collected in Feb.
Uses.—Medicinal. (Kirtikar).

5. **Cissampelos Pareira** Linn. Sp. Pl. (1753), 1031; H.F.B.I., i, 103; Dalz. & Gibs., 5; Trim. Fl. Ceyl., i, 46; Talb. For. F. Bomb. Pres., i, 45; Cooke. F. Pres. Bomb., i, 22; Watt. Dict. Econ. Prod. I., ii, 327.

Syn.—*Cissampelos convolvulacea* Willd. Sp. Pl., V, 863.
Indian Names.—Akandi, Dakhnir-bissi, Harjeuri (Hindi); Ambashtha, Brihat-tikta (Sans.); Padavali, Pharmul (Mar.); Pahadmul, Pahadvel (Bomb.); Appatta (Tam.); Adivibankatige (Tel.).
Habitat.—First collected in the Mulug forest (Warangal District), also subsequently collected at Ooperpalli and elsewhere.
Fowering season.—April-Sept.
Uses.—Medicinal (Kirtikar).

V. BERBERIDACEAE.

6. **Mahonia nepalensis** DC. Syst. ii, 21.

Syn.—*Berberis nepalensis* Spreng. Syst. ii, 120; H.F.B.I., i, 109.
Indian Names.—Amudanda, Chiror (Punjab); Gurm, Haldia (Garhwal); Chatri (Nepal).
Habitat.—Native of Temperate Himalaya. Cultivated in the Botanic Garden, Osmania University.
Flowering season.—Collected in flower in March.
Uses.—Medicinal (Kirtikar).

VI. CRUCIFERAE.

7. **Lepidium sativum** Linn. Sp. Pl. (1753), 644 (The Cress), H.F.B.I., i, 159; Watt. Dict. Econ. Prod. I., iv, 627; Cooke. F. Pres. Bomb., i, 35.

Indian Names.—Half, Hurf, Harfulabaz (Arab.); Chaunsar, Halim, Hurf (Hindi); Rukhame ispanda (Pers.); Chandrik (Sans.); Aliverai (Tamil); Adala vitulu (Tel.); Halim (Urdu).
Habitat.—Commonly cultivated.
Flowering season.—March and April.
Uses.—A good pot-herb, also medicinal.

VII. CAPPARIDACEAE.

8. **Cleome felina** Linn. f. Suppl., 300; H.F.B.I., 170.

Syn.—*Polanisia felina* DC. Prodr. i, 242.
Indian Names.—Ariavila (Malayalam).
Habitat.—Wild throughout the Dominions.
Uses.—Medicinal.

9. **Maerua arenaria** H. f. & T.; H.F.B.I., i, 171; Trim. F. Ceyl., i, 58.

Syn.—*M. ovalifolia* Cambess. in Jacquemont, Voy. Bot. (1844), 23, t. 24; Talb. For. F. Bomb. Pres., i, 48; Cooke. F. Pres. Bomb., i, 41. *Niebuhria oblongifolia* Royle, Ill. Himal. Bot., 73; Dalz. & Gibs., 8. *Capparis heteroclita* Roxb. F. Ind., ii, 570.
Indian Names.—Bhumi-chakkarai (Tam.); Bhuchakramu (Tel.).
Habitat.—Collected from Mulug forest.
Flowering season.—Nov.-Dec.
Uses.—Medicinal.

10. **Crataeva religiosa** Forst. *f. Prodr.* (1786), 35; H.F.B.I.; i, 172; Talb. For. F. Bomb. Pres., i, 64; Cooke. F. Pres. Bomb., i, 42; Watt. Dict. Econ. Prod. I., ii, 583.

Indian Names.—Varvunna (Hindi); Nirvala, Kamla, Waiwurna (Mar.).
Habitat.—Planted near temples. Apparently wild.
Flowering season.—March-April.
Uses.—Useful in turnery.

11. **Cadaba indica** Lamk. Encyc., i (1783), 544; H.F.B.I., i, 172; Trim. F. Ceyl., i, 60; Talb. For. F. Bomb. Pres., i, 50; Cooke. F. Pres. Bomb., i, 43; Dalz. & Gibs., 9.

Syn.—*Stroemeria tetrandra* Vahl., Roxb. F. Ind., ii, 78.
Habitat.—Collected from Mulug. Grows in dry situations.
Flowering season.—Nov.-Feb.

VIII. BIXACEAE.

12. **Bixa Orellana** Linn. (The Arnatto) Sp. Pl. (1753), 512; H.F.B.I., i, 190; Roxb. F. Ind., ii, 31; Dalz. & Gibs. Suppl., 5; Wight iii, t, 17.

Indian Names.—Japhar, Kesari, Shendri (Mar.); Kuppamannal (Malayalam); Arnuttu, Kesari (Canarese); Amudadaram (Tamil); Jabura (Tel.); Jolandhar (Beng.).
Habitat.—An American plant, cultivated in the Botanic Garden, Osmania University.
Flowering season.—Sept.
Uses.—The pulp surrounding the seeds gives a flesh coloured dye, used for colouring butter and for dyeing silk fabrics. Bark yields a good cordage. The West Indians rub two pieces of wood to produce fire. Medicinal.

IX. POLYGALACEAE.

13. **Polygala elongata** Klein in Willd. Sp. Pl., iii, 879; H.F.B.I., i, 203; Cooke. F. Pres. Bomb., i, 60.

Syn.—*P. campestris* Dalz. in Hook. Kew Journ. Bot., ii (1850), 40; Dalz. & Gibs., 13.
Habitat.—Wild at Adigmet and elsewhere in the Dominions.
Flowering season.—Sept.-Nov.

X. CARYOPHYLLACEAE.

14. **Polycarpæa corymbosa** Lam. Ill., ii (1793), 129; H.F.B.I., i, 245; Wt. Ic. t. 712; Cooke. F. Pres. Bomb., i, 66; Dalz. & Gibs., 16; Trim. F. Ceyl., i, 88.

Indian Names.—Bhistta (Sans.); Nilaisedachi (Tam.); Bommasari, Rajuma (Tel.).
Habitat.—Common throughout the Dominions.
Flowering season.—Oct.-Dec.
Uses.—Medicinal.

XI. MALVACEAE.

15. **Hibiscus vitifolius** Linn. Sp. Pl. (1753), 696; H.F.B.I., i, 338; Dalz. & Gibs., 20; Trim. F. Ceyl., i, 154; Cooke. F. Pres. Bomb., i, 109.

Indian Name.—Van-kapas (Mar.).
Habitat.—Collected from Humpii ruins, Raichur district. Not common.
Flowering season.—Feb.

16. **Hibiscus cancellatus** Roxb. Hort. Beng., 51; F.I., iii, 201; H.F.B.I., i, 342.

Habitat.—Collected from Sirnapalli forest (Nizamabad District). It is strange that this plant which is not found either towards Bombay or towards Madras, has been collected from this place.
Flowering season.—July-Aug.

17. **Hibiscus schizopetalus** Hook. f.; Bailey, Ency. Hort., 1487.

Habitat.—Cultivated as an ornamental shrub.
Flowering season.—Throughout the year.

18. **Urena lobata** Linn. Sp. Pl. (1753), 692; H.F.B.I., i, 329; Dalz. & Gibs., 18; Trim. F. Ceyl., i, 147; Cooke. F. Bomb. Pres., i, 100; Watt. Dict. Econ. Prod. I., vi, pt. 4, 212.

Indian Names.—Bachata, Bachita (Hindi); Otte (Canarese); Rantupkadu (Mar.); Van-bhendi (Bomb.); Vanachenda (Sans.); Ottatti (Tam.); Peddabenda (Tel.).
Habitat.—Common; first collected from Nizamabad.
Flowering season.—Oct.-Dec.
Uses.—Medicinal.

XII. STERCULIACEAE.

19. **Eriolæna Hookeriana** W. & A. Prodr., i, 70; H.F.B.I., i, 370; Cooke. F. Pres. Bomb., i, 131; Watt. Dict. Econ. Prod. I., iii, 265.

Indian Names.—Bute, Bother (Bomb.)
Habitat.—Collected from the Mulug forest.
Flowering season.—March-April.

20. **Waltheria indica** Linn. Sp. Pl. (1753), 673; H.F.B.I., i, 374; Dalz. & Gibs., 23; Cooke. F. Pres. Bomb., i, 135; Gamble. F. Pres. Mad., i, III.

Habitat.—Common everywhere in waste places, on roadsides, and as undergrowth in forests.
Flowering season.—Aug.-Oct.

21. **Melochia corchorifolia** Linn. Sp. Pl. (1753), 675; H.F.B.I., i, 374; Cooke. F. Pres. Bomb., i, 134.

Syn.—*Riedlea corchorifolia* DC. Prodr. i, 491; Dalz. & Gibs., 24.
Indian Names.—Ganugapindikura, Sittanta kura (Tel.); Pinnakkuppunda, Punnakkukkirai (Tam.); Seruvuram (Malayalam); Tikidkra (Beng.).
Habitat.—A widely spread weed, common at Adigmet and elsewhere.
Flowering season.—Collected in October.
Uses.—Medicinal (Kirtikar).

XIII. TILIACEAE.

22. **Grewia aspera** Roxb. Hort. Beng., 42; Fl. Ind., ii, 591.

Syn.—*Grewia abutilifolia* Juss. in Ann. Mus. iv, 92; H.F.B.I., i, 390; Dalz. & Gibs., 26; Cooke. F. Pres. Bomb., i, 144.
Habitat.—Common in Sirnapalli forest as an undergrowth in shady situations.
Flowering season.—June-July.

XIV. MALPIGHIACEAE.

23. **Banisteria laurifolia** Linn. Sp. Pl. ed. ii, 611.

Habitat.—Cultivated.
Flowering season.—Jan.-April.

XV. OXALIDACEAE.

24. **Biophytum sensitivum** DC. Prodr. i (1824), 690; H.F.B.I., i, 436; Dalz. & Gibs., 42; Cooke, F. Pres. Bomb., 167; Gamble. F. Pres. Mad., i, 133.

Indian Names.—Lajalu, Lakhshana, Zarer (Hindi); Jalapushpa (Sans.); Jharera, Ladjiri (Mar.); Jhalai (Beng.).
Habitat.—Cultivated.
Uses.—Medicinal (Kirtikar).

XVI. CELASTRACEAE.

25. **Celastrus paniculata** Willd. Sp. Pl., i, 1125; Roxb. Fl. Ind., i, 621; Dalz. & Gibs., 47; Wt. Ill. t., 72; Ic. t., 158.

Indian Names.—Malkakni, Malkamni, Malkangni (Hindi); Kangani, Malkangani (Mar.); Bavanji, Malkanguni, Maneru (Tel.); Kangli, Kangondi (Canarese); Lataphatakai, Malkangni (Bomb.); Sankhu (Punjab).

Habitat.—Common. First collected from the Sirnapalli forest (Nizamabad District).
Flowering season.—July-Aug.
Uses.—Medicinal.

26. **Gymnosporia Rothiana** M. Laws. l. c. 620; H.F.B.I., i, 620; Cooke. F. Pres. Bomb., ii, 232.

Syn.—*Celastrus Rothiana* Wt. & Arn. Prodr., 159; Dalz. & Gibs., 47 & 318.
Indian Name.—Yenkli (Bomb.).
Habitat.—Common throughout the Dominions.
Flowering season.—April-June.

XVII. VITACEAE.

27. **Vitis repanda** Wt. & Arn. Prodr. (1834), 125; H.F.B.I., i. 648; Trim. F. Ceyl., i, 292; Cooke. F. Pres. Bomb., ii, 251; Talb. For. F. Bomb. Pres., i, 312.

Syn.—*Cissus repanda* Vahl. Symb., iii, 18; Dalz. & Gibs., 39.
Indian Name.—Gendal (Bomb.).
Habitat.—Common in moist forest. First collected from Mulug forest (Warangal District).
Flowering season.—March-April.

XVIII. ANACARDIACEAE.

28. **Rhus mysurensis** Heyne, *ex Wt. & Arn. Prodr.* (1834), 172; Cooke. F. Pres. Bomb., ii, 272; Talb. For. F. Bomb. Pres., i, 347; Watt. Dict. Econ. Prod. I., vi, Pt. i, 497.

Indian Names.—Amani, Amoni (Bomb.).
Habitat.—Very common throughout the Dominions in dry situations, and in scrub jungle.
Uses.—Bark used in tanning. Wood is employed in fuel (Watt).

29. **Schinus molle** Linn. Sp. Pl. 388.

The so-called Weeping Willow of Nursery men.
Habitat.—A native of Tropical America. Cultivated.
Flowering season.—Dec.-Feb.

XIX. LEGUMINOSAE.

30. **Heylandia latebrosa** DC. Mem. Leg. (1825), 201; H.F.B.I., ii, 65; Cooke. F. Pres. Bomb., ii, 291; Dalz. & Gibs., 54.

Indian Name.—Godhadi (Bomb.).
Habitat.—Very common throughout the Dominions. First collected at Adigmet.
Flowering season.—March-June.

31. **Crotalaria hirsuta** Willd. Sp. Pl. iii, 978; Roxb. F. Ind. ii, 270; H.F.B.I., ii, 68; Gamble. F. Pres. Mad., ii, 293.

Syn.—*C. dichotoma* Heyne, ex Roth, Nov. Sp., 340.
Habitat.—Common at Adigmet.
Flowering season.—Collected in Sept.

32. **Crotalaria pusilla** Heyne, ex Roth, Nov. Pl. Sp. (1821), 335; H.F.B.I., ii, 70; Cooke. F. Pres. Bomb., ii, 296; Gamble. F. Pres. Mad., ii, 296.

Habitat.—Like the last species common at Adigmet.
Flowering season.—Sept.-Oct.

33. **Crotalaria albida** Heyne, ex Roth, Nov. Pl. Sp. (1821), 333; H.F.B.I., ii, 71; Cooke. F. Pres. Bomb., ii, 295.

Syn.—*Crotalaria punctata* Grah. in Wall. Cat. 5401.
Habitat.—Common in the Dominions.

34. **Crotalaria verrucosa** Linn. Sp. Pl. (1753), 715; H.F.B.I., ii, 77; Cooke. F. Pres. Bomb., ii, 299; Dalz. & Gibs., 55; Trim. F. Ceyl., ii, 15; Watt. Dict. Econ. Prod. I., ii, 614.

Indian Names.—Banshana, Jhunjhunia (Hindi); Ghagari (Mar.); Dhavani, Shanapushpi (Sans.); Ghelegherinta (Tel.).
Habitat.—Common at Adigmet.
Flowering season.—Oct.-Nov.
Uses.—Medicinal (Kirtikar).

35. **Crotalaria juncea** Linn. Sp. Pl. (1753), 714; H.F.B.I., ii, 79; Cooke. F. Pres. Bomb., ii, 301.

Indian Names.—Ghagahi, Patashana, Shanahuli (Hindi); Son (Pers.); Ghagharu, San, Tag (Mar.); Dhanahari, Sana (Sans.); Chanaka, Sanam (Malayalam); Chanai, Kuttiram (Tam.); Janumu, Gilaka (Tel.).
Habitat.—Cultivated.
Flowering season.—Nov.-Dec.
Uses.—The fibre is the *Sunn Hemp* of commerce. Leaves, flowers and seeds are medicinal.

36. **Crotalaria medicaginea** Lamk. Encyc. Method., ii (1786), 201; H.F.B.I., ii, 81; Trim. F. Ceyl., ii, 18; Cooke. F. Pres. Bomb., ii, 302.

Indian Names.—Gulabi (Hindi and Punj.); Jenjaru (Mar.); Ranmethi (Gujerati).
Habitat.—Collected from Mulug.
Flowering season.—Nov.-Dec.
Uses.—Officinal (Kirtikar).

37. **Crotalaria trifoliastrum** Willd. Sp. Pl., iii, 983; H.F.B.I., ii, 82.

Habitat.—Common at Adigmet.
Flowering season.—Collected in Aug.
Uses.—The root is medicinal (Kirtikar).

38. **Crotalaria umbellata** Wt. & Arn., 191; Gamble. F. Pres. Mad., ii, 294.

Syn.—*C. nana* Burm., H.F.B.I., ii, 71.
Habitat.—Collected from Mulug where it is very common.
Flowering season.—Dec.

39. **Indigofera cordifolia** Heyne, ex Roth. Nov. Pl. Sp. (1821), 357; H.F.B.I., ii, 93; Dalz. & Gibs., 58; Cooke. F. Pres. Bomb., ii, 311.

Indian Names.—Godadi, Bechka (Bomb.).
Habitat.—Common at Adigmet and elsewhere.
Flowering season.—Collected in April.
Uses.—Seeds are eaten in times of famine (Watt.).

40. **Indigofera enneaphylla** Linn. Mant. ii (1771), 571; H.F.B.I., ii, 94; Dalz. & Gibs., 58; Trim. F. Ceyl., ii, 22; Cooke. F. Pres. Bomb., ii, 312; Kirtikar, i, 709.

Syn.—*I. semitrijuga* Forsk. Fl. Aegypt—Arab., 137;
Indian Names.—Kenneggilu (Canarese); Bhuiguli (Mar.); Chalapachi, Cherragaddamu, Yerrapalleru (Tel.); Vasuka (Sans.), Cherupullate (Malayalam).
Habitat.—Common at Adigmet.
Flowering season.—Oct.
Uses.—Medicinal.

41. **Indigofera hirsuta** Linn. Sp. Pl. (1753), 751; H.F.B.I., ii, 98; Dalz. & Gibs., 60; Trim. F. Ceyl., ii, 26; Cooke. F. Pres. Bomb., ii, 319.

Habitat.—Common in all districts. First collected from Nalgonda.
Flowering season.—Oct.-Dec.

42. **Mundulea suberosa** Benth. Pl. Jungh., iii (1851-55), 248; H.F.B.I., ii, 110; Cooke. F. Pres. Bomb., ii, 322; Kirtikar, I. Med. Plts., i, 722.

Syn.—*Tephrosia suberosa* DC. Prodr ii, 249; Dalz. & Gibs., 60.

Indian Names.—Bettahuruli (Canarese); Supti, Surti (Bomb.); Kadupporasu, Pirala-varam (Tam.); Kondavempali, Palasaram (Tel.).
Habitat.—Collected from Nalgonda, common elsewhere also.
Flowering season.—Oct.-Dec.

43. **Zornia diphylla** Pers. Syn. Pl., ii (1807), 318; H.F.B.I., ii, 147; Trim. F. Ceyl., ii, 35; Cooke. F. Pres. Bomb., ii, 334.

Syn.—*Z. angustifolia* Sm.; Dalz. & Gibs., 62.
Indian Names.—Landgu (Bomb.); Nelammari (Malayalam).
Habitat.—Common at Adigmet.
Flowering season.—Aug.-Sept.
Uses.—Medicinal.

44. **Alysicarpus rugosus** DC. Prodr., ii (1825), 353; H.F.B.I., ii, 159; Gamble. F. Pres. Mad., ii, 338.

Syn.—*A. Wallichii* W. & A. Prodr., 234.
Habitat.—Collected from Adigmet.
Flowering season.—Sept.

45. **Desmodium latifolium** DC. Prodr., ii (1825), 328; H.F.B.I., ii, 168; Dalz. & Gibs., 66.

Trim. F. Ceyl., ii, 51; Cooke. F. Pres. Bomb., ii, 356.
Habitat.—Common in the moist forest at Mulug.
Flowering season.—Sept.-Nov.

46. **Desmodium gyrans** DC. (Telegraph Plant) Prodr., ii (1825), 326; H.F.B.I., ii, 174; Trim. F. Ceyl., ii, 56; Cooke. F. Pres. Bomb., ii, 358.

Habitat.—Hitherto not found wild. Cultivated in the Botanic Garden, Osmania University, for its well-known movements.

47. **Atylosia lineata** Wt. & Arn. Prodr. (1834), 258; H.F.B.I., ii, 213; Cooke. F. Pres. Bomb., ii, 382.

Syn.—*A. Lawii* Wt. Ic. t. 93; Dalz. & Gibs., 74.
Habitat.—Common in Mulug.
Flowering season.—Dec.

48. **Atylosia scarabæoides** Benth. Pl. Jungh., iii (1851-55), 243; H.F.B.I., ii, 215; Trim. F. Ceyl., ii, 79; Cooke. F. Pres. Bomb., ii, 384.

Syn.—*Cantharospermum pauciflorum* W. & A. Prodr., 255; Dalz. & Gibs., 73.
Habitat.—Common in Mulug in hilly tracts.
Flowering season.—Oct.-Nov.

LEGUMINOSAE.

(*Caesalpiniaceae*).

49. **Cassia Leschenaultiana** DC., Prain in Jour. As. Soc. Beng. cxvi, ii, 477.

Syn.—*C. Wallichiana* DC.; W. & A., 292. *C. mimosoides* var. *Wallichiana* Baker; H.F.B.I., ii, 266.
Habitat.—Not common.

50. **Bauhinia racemosa** Lamk. Encyc. Method., i (1783), 390; H.F.B.I., ii, 276; Cooke. F. Pres. Bomb., iii, 431; Dalz. & Gibs., 82.

Indian Names.—Ashta, Asoda, Papri (Hindi); Ara, Ayata (Canarese); Apata, Kanraja (Mar.); Are, Manjiyare, Pachare (Tel.); Anupushpaka (Sans.); Banraj (Beng.); Apta, Vanu-raja (Bomb.); Kotapuli, Mandaram (Malayalam).
Habitat.—Common in some of the deciduous forests.
Flowering season.—April-June.
Uses.—The fibre of the inner bark is used for making ropes. Leaves are pickled by the Burmese, and they are also used for making *bidis* in India. Medicinal.

XX. SAXIFRAGACEAE.

51. **Hydrangea hortensis** Sm. Ic. Pict. xii.

Habitat.—Cultivated in the Botanic Garden, Osmania University.

XXI. CRASSULACEAE.

52. **Bryophyllum tubiflorum** Harv. in Harv. & Sond. Fl. Cap., ii, 380.

Habitat.—Cultivated in rockeries. A xerophytic plant, multiplying by means of bulbils.
Flowering season.—Jan.

XXII. COMBRETACEAE.

53. **Terminalia citrina** Roxb. (Citrine Myrobalan). ex. Fleming in As. Res. xi (1810), 183. Roxb. Hort. Beng., 33; H.F.B.I., ii, 446.

Indian Names.—Haritaki, Harra (Beng.).
Habitat.—Common in the Mulug forest.
Flowering season.—Nov.-Dec.
Uses.—Medicinal.

54. **Combretum decandrum** Roxb. Cor. Pl. t. 59; H.F.B.I., ii, 452.

Habitat.—Collected from the Mulug forest.
Flowering season.—Dec.

XXIII. LYTHRACEAE.

55. **Ammania peploides** Spreng. Syst. Veg., i, (1825), 444; H.F.B.I., ii, 566; Trim. F. Ceyl., ii, 223; Cooke. F. Pres. Bomb., iii, 506.

Syn.—*Ameletia indica* DC. in Mem. Soc. Hist. Nat. Genev., iii, Pt. ii, 82; Dalz. & Gibs., 96.
Habitat.—Collected from a field in Mulug.
Flowering season.—Dec.

56. **Ammania baccifera** Linn. Sp. Pl. Ed. ii (1762), 175; H.F.B.I., ii, 569; Cooke. F. Pres. Bomb., iii, 509; Trim. F. Ceyl., ii, 224; Dalz. & Gibs., 97.

Syn.—*A. vesicatoria* Roxb. F. Ind., i (1820), 427; Kirtikar, Ed. ii, ii, 1072.
Indian Names.—Agya (Urdu); Dadmari, Jangli Mehndi (Hindi); Agnivenda-paku (Tel.); Bharajambhula (Mar.); Kallarivi (Tam.); Kshetrabhusha (Sans.); Dadmari (Beng.).
Habitat.—Also collected from a moist locality in Mulug.
Flowering season.—Nov.-Dec.
Uses.—Medicinal.

XXIV. ONAGRACEAE.

57. **Ludwigia parviflora** Roxb. Hort. Beng. (1814), ii; H.F.B.I., ii, 588; Cooke. F. Pres. Bomb., iii, 517; Dalz. & Gibs., 99; Trim. F. Ceyl., ii, 234; Wight. Ill. t., 101.

Habitat.—Hilly places in Mulug and elsewhere.
Flowering season.—Nov.—rather uncertain, because the old material in the Osmania University Herbarium is not dated.

XXV. TURNERACEAE.

58. **Turnera ulmifolia** Linn. Sp. Pl. 271. var. *angustifolia* Willd.; Gamble F. Pres. Mad., iii, 523. Mayuranathan. Fl. Plts. Madras City., 124.

Habitat.—Collected from an old well in the ruins of Mushk Mahal, and later on from a waste place towards Osmansagar. It is interesting to note that this plant, a native of the West Indies, should be found growing wild in a few places in Hyderabad. It has not, however, propagated profusely. Neither has Hooker nor Cooke recorded it.
Flowering season.—Aug.

XXVI. PASSIFLORACEAE.

59. **Passiflora edulis** Sims. Bot. Mag. t. (1989); Kirt. Ind. Med. Plts. II Ed., ii, 1103.

Habitat.—A native of Brazil, cultivated for its fruit.
Uses.—Fruit edible and medicinal.

XXVII. CUCURBITACEAE.

60. **Ctenolepis Garcini** Naud. in Ann. Sc. Nat. Ser. 5, vi, 13; H.F.B.I., ii, 629.

Habitat.—Collected from Sirnapalli (Nizamabad District).
Flowering season.—July-Aug.

XXVIII. FICOIDACEAE.

61. **Mollugo oppositifolia** Linn. Sp. Pl. (1753), 89; Cooke. F. Pres. Bomb., iii, 558; Kirt. Ind. Med. Plts., ii, Ed., ii, 1184.

Syn.—*M. Spergula* Linn. Syst. ed. 10 (1759), 881.
Indian Names.—Jima (Hindi); Parpataka (Canarese); Jharasi (Mar.); Kaipajira (Malayalam); Phanija (Sans.); Kachantarai (Tam.); Chayun-tarashiaku (Tel.).
Habitat.—Common at Adigmet.
Flowering season.—Sept.-Oct.
Uses.—Medicinal.

62. **Mollugo pentaphylla** Linn. Sp. Pl. (1753), 89; Cooke. F. Pres. Bomb., iii, 558; Dalz. & Gibs., 16.

Syn.—*M. stricta* Linn. Sp. Pl. Ed. ii (1762), 131.
Indian Names.—Jharasa (Mar.); Verrichatarasi (Tel.); Julpapra (Beng.).
Habitat.—Common elsewhere.
Flowering season.—Sept.-Nov.
Uses.—Occasionally eaten for its good properties. Medicinal.

XXIX. UMBELLIFERAE.

63. **Hydrocotyle asiatica** Linn. (Asiatic Penny-wort) Sp. Pl. (1753), 234; H.F.B.I., ii, 669; Dalz. & Gibs., 105; Wt. Icon. t., 565; Cooke. F. Pres. Bomb., iii, 562.

Indian Names.—Barhmi (Urdu); Brahmamanduki (Hindi & Beng.) Babassa (Tam. & Tel.); Brahmi (Mar.); Kodagam (Malayalam).
Habitat.—Near water-courses. First collection from a shaded moist situation near a stream in Mulug.
Flowering season.—May-Oct.
Uses.—Medicinal.

XXX. ARALIACEAE.

64. **Panax fruticosum** Linn. Sp. Pl. ed. ii, 1513; H.F.B.I., ii, 725; Dalz. & Gibs. Suppl. 142; Cooke. F. Pres. Bomb., iii, 574.

Habitat.—Commonly grown for its foliage.

XXXI. RUBIACEAE.

65. **Stephegyne parvifolia** Korth. in Verh. Gesch. Nat. Bot., 161; H.F.B.I., iii, 25.

Habitat.—Common in Mulug forest.
Flowering season.—Nov.

66. **Oldenlandia herbacea** Roxb. Hort. Beng. (1814), ii; Fl. Ind., i, 424; Cooke. F. Pres. Bomb., iii, 589.

Syn.—*O. Heynii* G. Don. Syst. iii (1834), 531; H.F.B.I., iii, 65. *Hedyotis herbacea* Linn. Sp. Pl. (1753), 102. *Hedyotis Heynii* Br. in Wall. Cat., 867; Dalz. & Gibs., 116.

Habitat.—Collected from Nalgonda, also common elsewhere.
Flowering season.—Aug.
Uses.—*Medicinal* (Kirtikar).

67. **Oldenlandia dichotoma** Koen; H.F.B.I., iii, 67; Cooke. F. Pres. Bomb., iii, 590; Gamble. F. Pres. Mad., iv, 601.

Syn.—*Hedyotis dichotoma* W. & A. 416 *in part. Hedyotis Heynei* Bedd. Icon. Pl. Ind. Or. t., 33.
Habitat.—Nalgonda, in moist places.
Flowering season.—July-Sept.

68. **Randia dumetorum** Lamk. Tab. Encyc., ii (1793), 227; H.F.B.I., iii, 110; Dalz. & Gibs., 119.

Syn.—*Randia longispina* DC. Prodr., iv, 386; Dalz. & Gibs., 119; Cooke. F. Pres. Bomb., iii, 600.
Indian Names.—Mainphal (Urdu); Arar, Mainphal (Hindi); Gehela (Deccan); Galay, Ghela, Madan (Mar.); Madanamu (Tel.); Kadudam, Karai (Tam.).
Habitat.—Common in the Mulug and Sirnapalli forests.
Flowering season.—May.
Uses.—The fresh fruit is roasted and eaten. The wood is used for agricultural implements and for fuel. The plant is sacred amongst Hindus. Medicinal (Watt.).

69. **Gardenia latifolia** Ait. Hort. Kew., i (1789), 294; H.F.B.I., iii, 116; Cooke. F. Pres. Bomb., iii, 602; Dalz. & Gibs., 120; Wt. Icon. t., 759; Trim. F. Ceyl., ii, 332.

Habitat.—Very common in Mulug, Sirnapalli, and Vikarabad.
Flowering season.—April-June, fruit in Aug.
Uses.—The wood is used in making combs.

70. **Canthium parvifolium** Roxb. Hort. Beng., 15; Fl. Ind., i, 534; H.F.B.I., iii, 135.

Habitat.—Vicinity of Adigmet.
Flowering season.—Collected in the fruiting condition in Aug.

71. **Pavetta indica** Linn. (Indian Pellet Shrub) Sp. Pl. (1753), 110; H.F.B.I., iii, 150; Cooke. F. Pres. Bomb., iii, 612; Dalz. & Gibs., 112; Wt. Icon. t., 148.

Syn.—*Ixora Pavetta* Roxb. Fl. Ind., 385.
Indian Names.—Kankra, Papari (Hindi); Pappadi (Canarese); Papadi (Mar.); Nallapapidi; Tapra (Tel.); Pavaltai (Tam.); Papat (Bomb.); Kukurachura (Beng.).
Habitat.—Common in hills in the Mulug forest.
Flowering season.—April-May.
Uses.—Medicinal (Kirtikar).

72. **Hamiltonia suaveolens** Roxb. Hort. Beng. (1814), 15; H.F.B.I., iii, 197; Cooke. F. Pres. Bomb., iii, 621.

Syn.—*Hamiltonia mysorensis* Wt. & Arn. Prodr., 423; Dalz. & Gibs., 115.
Indian Names.—Gidasawa, Gidesa (Bomb.); Mahabal (C.P.); Fisauni, Gohinla, Kanera (Punjab).
Habitat.—Collected from the hills in Khuldabad (Aurangabad District).
Flowering season.—Feb. Fruit in June.
Uses.—Medicinal.

73. **Spermacoce stricta** Linn. f. Suppl. (1781), 120; H.F.B.I., iii, 200; Cooke. F. Pres. Bomb., iii, 623.

Habitat.—Common at Adigmet and elsewhere.
Flowering season.—Aug.-Oct.

XXXII. COMPOSITAE.

74. **Vernonia cinerea** Less. in Linnaea, iv (1829), 291; H.F.B.I., iii, 233; Dalz. & Gibs., 121; Cooke. F. Pres. Bomb., Vol. ii, Pt. i, 10.

Indian Names.—Dandotpala, Sahadevi (Hindi); Osari, Sadodi, Sahadevi (Mar.); Garitikamma (Tel.); Puvamkurundal, Sahadevi (Tam.); Sadodi, Shedardi (Guj.); Puvankuruntal (Malayalam); Sahadevi (Punjab); Dandotpala, Devasasha, Devika (Sans.).

Habitat.—A common weed.

Flowering season.—Dec.- Feb.

Uses.—Medicinal.

75. **Ageratum mexicanum** Sims., Bailey, Cycl. Hort. 239.

Habitat.—A much-cultivated annual.

Flowering season.—Winter, about Dec. and Jan.

76. **Blumea Wightiana** DC. in Wt. Contrib. (1834), 14; H.F.B.I., iii, 261; Cooke. F. Pres. Bomb., Vol. ii, Pt. i, 19; Dalz. & Gibs., 125.

Habitat.—Common in waste places round about Adigmet and elsewhere.

Flowering season.—Dec.-Feb.

77. **Helichrysum** sp. (Everlasting Straw Flower).

Habitat.—A hardy annual grown for its beautiful flowers.

78. **Pulicaria angustifolia** DC. Prodr., v, (1836), 479; H.F.B.I., iii, 299; Cooke. F. Pres. Bomb., Vol. ii, Pt. i, 34; Clarke, Comp. Ind., 129.

Syn.—*Callistephus concolor* Dalz. in Kew Jour. Bot., ii, 344.

Habitat.—Common at Adigmet and elsewhere.

Flowering season.—Nov.

79. **Lagasca mollis** Cav. in Anal. Cienc. Nat., vi (1803), 332; H.F.B.I., iii, 302.

Habitat.—Common in grass lands.

Flowering season.—Almost throughout the year.

80. **Acanthospermum hispidum** DC., Gam. F. Pres. Mad., Pt. iv, No. 4, 704.

Habitat.—A South American plant spreading rapidly here.

Flowering season.—Aug.

81. **Sclerocarpus africanus** Jacq. Icon. Pl. Rar., (1782), 17; H.F.B.I., iii, 305; Cooke. F. Pres. Bomb., Vol. ii, Pt. i, 39; Dalz. & Gibs., 129; Clarke, Comp. Ind., 134.

Habitat.—Common in the Dominions in hilly regions.

Flowering season.—July-Aug.

82. **Tridax procumbens** Linn. Sp. Pl. (1753), 1900; H.F.B.I., iii, 311; Clarke, Comp. Ind., 142; Cooke. F. Pres. Bomb., Vol. ii, Pt. i, 45.

Habitat.—Although a native of Central America, it is found as a common weed throughout the Dominions.

Flowering season.—Almost throughout the year.

83. **Flaveria australasica** Hook., Benth. Fl. Aust., iii, 546; Gamb. F. Pres. Mad., Pt. iv, No. 4, 711; Mayuranathan, Fl. Plts. Mad. City., 152.

Habitat.—A herb introduced from Australia, now common in moist places.

84. **Gynura nepalensis** DC. Prodr. vi, 300; H.F.B.I., iii, 333; Clarke, Comp. Ind., 171.

Habitat.—Much grown for its handsome foliage and flowers.

85. **Emilia sonchifolia** DC.; H.F.B.I., iii, 336; Gamble, F. Pres. Mad., iv, 716.

Habitat.—Common in rice-fields.

86. **Notonia grandiflora** DC. in Wt. Contrib. (1834), 24; H.F.B.I., iii, 337; Clarke. Comp. Ind., 176; Cooke. F. Pres. Bomb., Vol. ii, Pt. i, 50; Dalz. & Gibs., 133.

Indian Names.—Gaidar (Bomb.); Wander-roti (Mar.); Kunde-lucheviyaku (Tel.).
Habitat.—Not wild. Often grown in gardens.
Uses.—Medicinal (Kirtikar).

87. **Tricholepis radicans** DC. Prod., vi (1837), 564; H.F.B.I., iii, 381; Clarke, Comp. Ind., 239; Cooke. F. Pres. Bomb., Vol. ii, Pt. i, 56; Dalz. & Gibs., 131.

Habitat.—Nalgonda.
Flowering season.—Dec.-Jan.

88. **Dicoma tomentosa** Cass. in Bull. Soc. Philom (1818), 47; H.F.B.I., iii, 387; Clarke, Comp. Ind., 245; Cooke. F. Pres. Bomb., Vol. ii, Pt. i, 58.

Syn.—*Dicoma lanuginosa* DC. in Wt. Contrib. (1834), 26; Dalz. & Gibs., 132.
Indian Names.—Navananjichapala (Belgaum); Gholoharnacharo (Gujerati).
Habitat.—Common on gravelly soil.
Flowering season.—Dec.-Feb.
Uses.—Medicinal.

89. **Cichorium Intybus** Linn. (Chicory), Sp. Pl. (1753), 813; H.F.B.I., iii, 391; Kirt. Ind. Med. Plts., ii, 1433.

Indian Names.—Kasani (Urdu, Pers. and Gujerati); Kasni (Hindi); Kasini (Tel.); Kashini (Tam).
Habitat.—It is rather strange that Abdus Salam found it growing wild near a canal at Himayathnagar. Since then its development and distribution is under observation.
Flowering season.—Feb.
Uses.—Medicinal.

90. **Sonchus oleraceus** Linn. Sp. Pl. (1753), 794; H.F.B.I., iii, 414; Cooke. F. Pres. Bomb., ii, 61. *Sonchus ciliatus* Lam. F. Fr., ii, (1778), 87; Wt. Icon. t. 1141.

Indian Names.—Ratrinta (Tel.); Mhatara (Bomb.).
Habitat.—Apparently wild in cultivated lands and gardens, also on road-sides. Probably an introduction.
Flowering season.—Oct.-Jan.
Uses.—Medicinal.

91. **Launaea pinnatifida** Cass. in Ann. Sc. Nat. Ser. 1, xxiii (1831), 85; H.F.B.I., iii, 416; Cooke. F. Pres. Bomb., ii, Pt. i, 64; Kirt. Ind. Med. Plts. ii, 1447.

Syn.—*Microrhynchus sarmentosus* DC. Prodr., vii, 181; Wt. Ill. t., 131; Clarke, Comp. Ind., 277; Dalz. & Gibs., 132. *Prenanthes sarmentosa* Willd. Sp. Pl., iii, 1540; Grah. Cat., 94.
Indian Names.—Bankan (Hindi); Bhonpatri, Pathradi (Mar.); Pathri (Bomb.); Bhonpatri (Gujerati).
Habitat.—A common sandbinder.
Flowering season.—Nov.-Dec.
Uses.—Medicinal.

XXXIII. EBENACEAE.

92. **Maba nigrescens** Dalz. & Gibs. Bomb. Fl. (1861), 142; H.F.B.I., iii, 551; Cooke. F. Pres. Bomb., ii, Pt. i, 97.

Indian Name.—Rakta-rora (Bomb.).
Habitat.—Common in Mulug forest.
Flowering season.—Nov.-Feb.
Uses.—The wood is used in making rafters.

XXXIV. OLEACEAE.

93. **Jasminum auriculatum** Vahl. Symb. Bot., iii (1794), 1; H.F.B.I., iii 600; Cooke. F. Pres. Bomb., ii, Pt. i, 113; Kirt. Ind. Med. Plts., ii, 1524.

Indian Names.—Adavimolla (Tel.); Hurinaballi (Canarese); Mullaikkodi (Tam.); Ambashtha, Jai (Sans.).

Habitat.—Common at Anantgiri Hill (Vikarabad).
Flowering season.—May-Aug.
Uses.—Medicinal.

94. **Ligustrum robustum** Blume Mus. Bot. i, 313; H.F.B.I., iii, 614.
Habitat.—Cultivated.

XXXV. SALVADORACEAE.

95. **Salvadora persica** Linn. (The Tooth-brush Tree) Sp. Pl. (1753), 122; H.F.B.I., iii, 619; Cooke. F. Pres. Bomb., ii, Pt. i, 121.

Syn.—*S. indica* Wight Ill. t. 181. *S. Wightiana* Planch. in Thw. Enum., 190; Bedd. Flor. Sylvat. t. 247.
Indian Names.—Pilu, Pilva (Mar.); Khakan (Bomb.); Waragarwenki (Tel.); Pilu (Sans.); Arak (Arab.); Darakhti-misvak (Pers.).
Habitat.—Probably a cultivated tree.
Flowering season.—Dec.-Feb.
Uses.—Fruits are eaten. Wood is employed for making tooth-brushes. Medicinal.

XXXVI. APOCYNACEAE.

96. **Rauwolfia serpentina** Benth. ex Kurz For. Fl. Brit. Burma, ii (1877), 171; H.F.B.I., iii, 632; Cooke. F. Pres. Bomb., ii, Pt. i, 127.

Syn.—*Ophioxylon serpentinum* Linn. Sp. Pl. (1753), 104; Dalz. & Gibs., 143; Roxb. Fl. Ind., i, 694.
Indian Names.—Chhotachand (Hindi); Chandrike (Canarese); Dumparasna, Patalagandhi (Tel.); Harkaya, Harki (Mar.); Sovannamilbori (Tam.); Chandra (Beng.); Amelpodi, Chandra, Chhotachand, Harkai (Bomb.).
Habitat.—Collected from Mulug forest.
Flowering season.—Dec.
Uses.—Medicinal.

XXXVII. ASCLEPIADACEAE.

97. **Calotropis procera** R.Br. in Ait. Hort. Kew. ed. 2, ii (1811), 78; H.F.B.I., iv, 18; Cooke. F. Pres. Bomb., ii, Pt. i, 152; Dalz. & Gibs., 149; Wt. Ic. t. 1278.

Indian Names.—Ak, Madar, Safedak (Hindi); Mandara (Mar.); Jilledu, Mandaramu, Nallajilledu (Tel.); Vellerukku (Tam.).
Habitat.—Common in dry situations throughout the Dominions.
Flowering season.—Nov.-Dec.
Uses.—Medicinal.

98. **Pergularia pallida** Wt. & Arn. in Wt. Contrib. (1834), 42; H.F.B.I., iv, 38; Wt. Icon. t. 585; Cooke. F. Pres. Bomb., ii, Pt. i, 164.

Habitat.—Collected from Adigmet.
Flowering season.—Feb.

99. **Pergularia extensa** N. E. Br. in Fl. Cap. iv, i, 758; Gamble. F. Pres. Mad., v, 837; Kirt. Ind. Med. Plts., iii, 1616.

Syn.—*Daemia extensa* R. Br., H.F.B.I., iv, 20; Wt. Icon. t. 596.
Indian Names.—Jutuk, Utran (Hindi); Utarana, Amaradudheli (Mar.); Dushtupatige, Guruti (Tel.); Belihatti (Canarese); Achanimuli, Kudagaram (Tam.); Veliparutti (Malayalam); Amaradudheli, Nagaladudhi (Gujerati); Utarni (Bomb.); Chagulbanti (Beng.); Karial (Punjab).
Habitat.—Common in Nalgonda District.
Flowering season.—Dec.
Uses.—Medicinal.

100. **Tylophora macrantha** Hook. f.; H.F.B.I., iv, 40; Gamble. F. Pres Mad., v, 842.

Habitat.—Collected from Mulug forest.
Flowering season.—Dec.

101. **Tylophora asthmatica** W. & A. in Wt. Contrib. (1834), 51; H.F.B.I., iv, 44; Wt. Ic. t. 1277; Cooke. F. Pres. Bomb., ii, Pt. i, 164.

Indian Names.—Antamul (Hindi); Kakapala, Kukkapala (Tel.); Pitakari (Mar.); Adumuttada (Canarese); Vallippala (Malayalam); Antomul (Beng.).
Habitat.—Common at Adigmet and elsewhere.
Flowering season.—Aug.-Nov.
Uses.—Medicinal.

102. **Ceropegia pusilla** W. & A. in Wt. Contrib. 31; Wight Icon. t. 1261; H.F.B.I., iv, 66; Gamble F. Pres. Mad., v, 856.

Habitat.—Collected from Adigmet from a grassy hillock.
Flowering season.—July.

103. **Ceropegia spiralis** Wt. Ic. t. 1267; H.F.B.I., iv, 66; Gamble. F. Pres. Mad., v, 856.

Habitat.—A common herb in dry, hilly situations.
Flowering season.—May-June.

104. **Ceropegia hirsuta** W. & A. in Wt. Contrib. (1834), 30; H.F.B.I., iv, 71; Cooke. F. Pres. Bomb., ii, Pt. i, 177; Gamble F. Pres. Mad., v, 859.
Indian Name.—Hamana (Bomb.).
Habitat.—Collected from the Mananur forest.
Flowering season.—Feb.

105. **Stapelia grandiflora** Masson, Stapel (1796), 13, t. 11; Cooke. F. Pres. Bomb., ii, Pt. i, 180.

Habitat.—A native of S. Africa, kindly presented by Dr. Gravely to the Botanic Garden, Osmania University.
Flowering season.—Summer, about April-June.

106. **Stapelia variegata** Linn. Sp. Pl. 217.

Habitat.—A native of S. Africa. Kindly presented by Dr. Gravely to the Botanic Garden, Osmania University.
Flowering season.—Summer—April to June.

XXXVIII. GENTIANACEAE.

107. **Canscora diffusa** R. Br. Prodr. (1810), 451 in Obs.; H.F.B.I., iv, 103; Cooke F. Pres. Bomb., ii, Pt. i, 191; Gamble F. Pres. Mad., v, 878; Kirt. Ind.. Med. Plts., iii, 1759.

Syn.—*C. Lawii* Wt. Ic. t. 1527 (not of C. B. Clarke).
Habitat.—A common herb at Adigmet and elsewhere.
Flowering season.—Jan.-April.
Uses.—Medicinal.

XXXIX. HYDROPHYLLACEAE.

108. **Hydrolea zeylanica** Vahl Symb. Bot. ii (1791), 46; H.F.B.I., iv, 133; Cooke F. Pres. Bomb., ii, Pt. i, 197; Gamble F. Pres. Mad., v, 884; Kirt. Ind. Med. Plts., iii, 1672.

Indian Names.—Langali (Sans.); Cheruvallel (Malayalam); Ishangulya, Kasschra (Beng.).
Habitat.—A common marsh herb.
Flowering season.—Dec.
Uses.—Medicinal.

XL. BORAGINACEAE.

109. **Coldenia procumbens** Linn. Sp. Pl. (1753), 125; H.F.B.I., iv, 144; Cooke F. Pres. Bomb., ii, Pt. i, 205; Dalz. & Gibs., 171; Kirt. Ind. Med. Plts., iii, t. 1683.

Indian Names.—Tripungki (Hindi); Tripunkhi (Mar.); Hampadi (Tel.); Serupadi (Tam.); Basriookharad (Guj.); Tripakshi (Sans. & Bomb.).
Habitat.—Found in moist places.
Flowering season.—Sept.-Oct.
Uses.—Medicinal.

110. **Heliotropium brevifolium** Wall. Cat. 914. *H. strigosum* var. *brevifolia* Clark; H.F.B.I., iv, 151.

Indian Names.—Chitiphul, Safedbhangra (Hindi); Gorakh-pamo (Punjab).
Habitat.—A common herb.
Flowering season.—Aug.-Sept.
Uses.—Medicinal.

XLI. CONVOLVULACEAE.

111. **Argyreia cymosa** Sweet Hort. Brit. ed. ii, 373; H.F.B.I., iv, 190; Wt. Ic. t., 839; Cooke F. Pres. Bomb., ii Pt. ii, 257; Gamble F. Pres. Mad., v, 908.

Habitat.—Found in hedges and scrub jungles.
Flowering season.—May.

112. **Ipomaea chryseides** Ker in Bot. Reg. t., 270; H.F.B.I., iv, 206; Wt. Ic. t., 157.

Syn.—*Convolvulus chryseides* Spreng. Syst., i, 598. *Convolvulus dentatus* Vahl Symb., iii, 25.
Habitat.—Collected from Mulug forest.
Flowering season.—Dec.

113. **Ipomaea Turpethum** Br. Prodr., 485; H.F.B.I., iv, 212; Dalz. & Gibs., 165.

Syn.—*Ipomaea triquetra* Roem. & Sch. Syst., iv, 231. *Convolvulus turpethum* Linn.; Roxb. Hort. Beng., 14.
Habitat.—Common in Mulug.
Flowering season.—Dec.

114. **Ipomaea Horsfalliae** Hook. Bot. Mag. (1834) t., 3315; Cooke F. Pres. Bomb., ii, Pt. ii, 252.

Habitat.—A native of W. Indies, grown for its beautiful crimson flowers.
Flowering season.—Almost throughout the year.

XLII. SOLANACEAE.

115. **Solanum pubescens** Willd. Phyt. (1794), 5; H.F.B.I., iv, 230; Wt. Ic. t., 1402; Cooke F. Pres. Bomb., ii, Pt. ii, 263.

Habitat.—Cultivated.
Flowering season.—Aug.-Nov.

116. **Solanum torvum** Swartz Prodr., 47; H.F.B.I., iv, 234; Dalz. & Gibs., 175; Cooke F. Pres. Bomb., ii, Pt. ii, 269.

Indian Names.—Kondavust (Tel.); Chunta (Malayalam); Titbaigum (Beng.).
Habitat.—Collected from the city environs.
Flowering season.—July.
Uses.—Fruits are eaten as vegetables, also medicinal.

117. **Solanum trilobatum** Linn. Sp. Pl. (1753), 188; H.F.B.I., iv, 236; Cooke F. Pres. Bomb., ii, Pt. ii, 267; Kirt. Ind. Med. Plts., iii, 1762.

Indian Names.—Alarkapatramu (Tel.); Ambusondeballi, Kakamunji (Canarese); Achuda (Sans.).
Habitat.—Common in Mulug.
Flowering season.—Dec.
Uses.—Medicinal.

118. **Solanum Seaforthianum** Andr. Bot. Rep. t. 504. (Blue Potato Creeper).

Habitat.—A native of Tropical America. Grown for its pretty white and blue flowers.

XLIII. SCROPHULARIACEAE.

119. **Celsia coromandeliana** Vahl Symb. Bot. iii (1794), 79; H.F.B.I., iv, 251; Cooke F. Pres. Bomb., ii, Pt. ii, 281; Kirt. Ind. Med. Plts., iii, 1807.

Indian Names.—Gadartambaku, Kokshima (Hindi); Kolhala, Kutki (Mar.); Kohhal (Bomb.); Kalhara (Guj.); Koksima (Beng.).

Habitat.—Collected from Khuldabad.
Flowering season.—June.
Uses.—Medicinal.

120. **Limnophila racemosa** Benth. Scroph. Ind. (1835), 26; H.F.B.I., iv, 271; Dalz. & Gibs. 177; Cooke F. Pres. Bomb., ii, Pt. ii, 291; Wt. Ic. t. 861.

Indian Name.—Mahaka (Bomb.).
Habitat.—Common in marshy places in Mulug and elsewhere.
Flowering season.—Dec.

121. **Bonnaya veronicaefolia** Spreng. Syst. Veg., i (1825), 41; H.F.B.I., iv, 285; Cooke F. Pres. Bomb., ii, Pt. ii, 298; Dalz. & Gibs., 178.

Indian Names.—Shewal (Bomb.).
Habitat.—Common in moist places towards Vikarabad, Mulug and elsewhere.
Flowering season.—Nov.-Dec.

122. **Angelonia grandiflora** C. Morr. in Ann. Soc. Hort. Gand, iii, 93, t. 119.

Habitat.—Extensively cultivated in gardens.
Flowering season.—Winter.

XLIV. BIGNONIACEAE.

123. **Bignonia venusta** Ker—Gawl. in Bot. Reg. t. 249.

Habitat.—Cultivated for its beautiful flowers.
Flowering season.—Dec.-March.

124. **Tecoma jasminoides** Lindl. Bailey, Encyc. Hort. 3317.

Habitat.—Cultivated.
Flowering season.—Almost throughout the year.

XLV. ACANTHACEAE.

125. **Thunbergia fragrans** Roxb. Cor. Pl., 1 (1795), 47, t, 67; H.F.B.I., iv, 390; Cooke F. Pres. Bomb., ii, Pt. ii, 342; Dalz. & Gibs., 183.

Indian Name.—Chimine (Bomb.).
Habitat.—A common garden escape.
Flowering season.—Almost throughout the year.
I agree with Cooke that the specific name is a misnomer. I have examined many flowers from several plants, and have satisfied myself that there is absolutely no fragrance.

126. **Thunbergia grandiflora** Roxb. Hort. Beng. (1814), 45; H.F.B.I., iv, 392; Cooke F. Pres. Bomb., ii, Pt. ii, 343.

Habitat.—Commonly grown in gardens.

127. **Thunbergia mysorensis** T. Andres. in Jour. Linn. Soc., ix (1867), 448; H.F.B.I., iv, 393; Cooke F. Pres. Bomb., ii, Pt. ii, 342; Dalz. & Gibs., 183.

Habitat.—Cultivated.
Flowering season.—Dec.

128. **Elytraria crenata** Vahl Enum., i, 106; H.F.B.I., iv, 394; Dalz. & Gibs., 183.

Habitat.—Collected from the Mulug forest.
Flowering season.—Dec.-March.

129. **Hygrophila polysperma** T. Andres, in Jour. Linn. Soc., ix (1867), 456; H.F.B.I., iv, 406; Cooke F. Pres. Bomb., ii, Pt. ii, 353.

Syn.—*Hemiadelphis polysperma* Nees. in Watt. Pl. As. Rar., iii, 80; Wt. Ic. t. 1492.

Habitat.—Common in marshy places throughout.
Flowering season.—Nov.-Dec.

130. **Hygrophila spinosa** T. Andres. in Thwaites Enum. 225, and in Jour Linn. Soc., vii, 22; H.F.B.I., iv, 408.

Habitat.—Common in ditches near tanks and fields.
Flowering season.—Feb.

131. **Ruellia longifolia** T. Andres. in Jour. Linn. Soc., ix (1867), 460; H.F.B.I., iv, 412; Watt. Dict. Econ. Prod. I., vi, Pt. i, 589.

Syn.—*Dipteracanthus longifolius* Stocks, in Kew Jour., Bot., iv (1852), 177.
Habitat.—Vicinity of Adigmet.
Flowering season.—Undated sheet in Herbarium Hyderabadense.

132. **Ruellia tuberosa** Linn. Sp. Pl. 635.

Habitat.—Collected from Adigmet, a cultivated plant.
Flowering season.—Undated sheet in Herbarium Hyderabadense.

133. **Phaylopsis parviflora** Willd. Sp. Pl., iii, 342; H.F.B.I., iv, 417.

Habitat.—Collected from Mulug forest.
Flowering season.—Dec.

134. **Strobilanthus Kunthianus** T. Andres. in Jour. Linn. Soc., ix, 465; H.F.B.I., iv, 434.

Habitat.—Common in the vicinity of Adigmet.
Flowering season.—Nov.-Dec.

135. **Blepharis bœrhaaviæfolia** Pers. Syn., ii (1807), 180; H.F.B.I., iv, 478; Cooke F. Pres. Bomb., ii, Pt. ii, 349; Dalz. & Gibs., 192; Wt. Ic. t., 458.

Habitat.—Collected from Mulug.
Flowering season.—Dec.

136. **Barleria cuspidata** Heyne; Nees in Wall. Pl. As. Rar., iii, 93 and in DC. Prodr., xi, 239; H.F.B.I., iv, 483; Cooke F. Pres. Bomb., ii, Pt. ii. 380; Wt. Ic. t. 451.

Habitat.—Common at Adigmet.
Flowering season.—Dec.

137. **Barleria strigosa** Willd. Sp. Pl., iii (1800), 379; H.F.B.I., iv, 489; Cooke F. Pres. Bomb., ii, Pt. ii, 384; Kirt. Ind. Med. Plts., iii, 1880.

Syn.—*Barleria terminalis* Nees in DC. Prodr., xi (1847), 225; Dalz. & Gibs., 188. *B. coerulea* Grah. Cat., 161.
Indian Names.—Nilam baramu (Tel.); Nilambaram, Nili (Tam.); Nilakurinni (Malayalam); Wahiti (Bomb.); Dasi (Beng.); Nilakurantaka (Sans.).
Habitat.—Collected from Mulug forest.
Flowering season.—Dec.
Uses.—Medicinal.

138. **Phlogacanthus curviflorus** Nees in Wall. Pl. As. Rar. iii, 113 and in DC. Prodr., xi, 320; H.F.B.I., iv, 511; Cooke F. Pres. Bomb., ii, Pt. ii, 417.

Habitat.—A native of khasia mountains, cultivated for its showy brick-red flowers.

139. **Rhinacanthus communis** Nees in Wall. Pl. As. Rar. iii, 109, and in DC. Prodr., xi, 442; H.F.B.I., iv, 541.

Habitat.—Doubtfully indigenous.

140. **Peristrophe bicalyculata** Nees in Wall. Pl. As. Rar. ii, 113 and in DC. Prodr. xi, 496; H.F.B.I., iv, 554; Cooke F. Pres. Bomb., ii, Pt. ii, 415; Dalz. & Gibs., 197.

Indian Names.—Atrilal, Itrelal, Masi (Hindi); Ghatipittapapada, Rankirayat (Mar.); Chebira (Tel.); Pitpatra (Sans.); Nasabhaga (Beng.).
Habitat.—Common in Mulug and elsewhere.
Flowering season.—Nov.-Dec.
Uses.—Supposed to be medicinal.

141. **Fittonia argyroneura** E. Coem. in Fl. des Serres, xvi (1865), 103.

Habitat.—A native of Peru, grown in gardens.

XLVI. VERBENACEAE.

142. **Vitex Negundo** Linn. (Indian Privet) Sp. Pl. (1753), 638; H.F.B.I., iv, 583; Cooke F. Pres. Bomb., ii, Pt. ii, 428.

Syn.—*Vitex bicolor* Willd. Enum. Hort. Berol, 660 (in note); Dalz. & Gibs., 201; *Vitex trifolia* Grah. Cat., 155 (not of Linn.).

Indian Names.—Nirgandi (Hindi); Shamalu, Shambalu (Deccan); Nirgunda, Lingur (Mar.); Nallavavili (Tel.); Nochi (Canarese); Nirkkundi (Tam.); Banjangasht, Sisban (Pers.); Aslag, Fanjangasht (Arab.); Indrani, Nilapushpa (Sans.); Nirgundi (Bomb.); Bankhu (Punjab).

Habitat.—A common large shrub along roadsides near villages.

Flowering season.—Almost throughout the year.

Uses.—Medicinal.

143. **Clerodendron phlomidis** Linn. f. Suppl. (1781), 292; Cooke F. Pres. Bomb., ii, Pt. ii, 431.

Syn.—*Clerodendron phlomoides* Willd. Sp. Pl., iii (1800), 386; H.F.B.I., iv, 590; Dalz. & Gibs., 200; Wt. Ic. t. 1473.

Indian Names.—Arnl, Piran (Hindi); Talaki, Tekkali (Tel.); Sayandi, Takkari (Tam.); Arni, Irun (Guj.); Tirutali (Malayalam); Arani, Agnimantha, Gandhapushpa (Sans.).

Habitat.—Common in Mulug and elsewhere, growing in hedges in dry situations.

Flowering season.—Nov.-Feb.

Uses.—Medicinal.

144. **Clerodendron serratum** Spreng. Syst. Veg., ii (1825), 758; H.F.B.I., iv, 592; Wt. Ic. t. 1472; Cooke F. Pres. Bomb., ii, Pt. ii, 432; Dalz. & Gibs., 200.

Indian Names.—Barangi (Hindi); Bharangi (Urdu and Bomb.); Barangi, Bhramaramari (Tel.); Bharangi (Mar.); Gantubarangi (Canarese); Cherutekku (Malayalam); Bharangi Bhargavi, Bramhi (Sans.).

Habitat.—Common on the Telangana side.

Flowering season.—Sept.

Uses.—Medicinal.

145 **Verbena chamaedryfolia** Jus. in Ann. Mus. Par., vii (1806), 73; Cooke F. Pres. Bomb., ii, Pt. iii, 437.

Habitat.—A native of S. America, several hybrids of which are grown largely in gardens.

146 **Holmskioldia sanguinea** Retz. Obs. fasc., vi (1791), 31; Cooke F. Pres. Bomb., ii, Pt. iii, 437; Watt. Dict. Econ. Prod. I., iv, 260.

Habitat.—A native of the subtropical Himalaya. Its large rounded red calyx is remarkable. Commonly grown in gardens.

XLVII. LABIATAE.

147. **Coleus spicatus** Benth. in Wall. Pl. As. Rar., ii (1831), 15; H.F.B.I., iv, 624; Wt. Ic. t. 1431; Cooke F. Pres. Bomb., ii, Pt. iii, 449.

Syn.—*Coleus Zatarhendi* Dalz. & Gibs., 206.

Habitat.—A strongly scented herb. Collected from Mananur. It was growing among bushes on stony ground.

Flowering season.—Dec.-Feb.

148. **Hyptis suaveolens** Poit. in Ann. Mus. Par., vii (1806), 472; H.F.B.I., iv, 630; Cooke F. Pres. Bomb., ii, Pt. ii, 476; Kirt. Ind. Med. Plts., iii, 2032.

Habitat.—A native of Tropical America, has become naturalized in many parts of India. Collected from Mulug.

Flowering season.—Dec.

Uses.—Medicinal.

149. **Dysophylla myosuroides** Benth. in Wall. Pl. As. Rar., i (1830), 30; H.F.B.I., iv, 638; Cooke F. Pres. Bomb., ii, Pt. iii, 456.

Habitat.—Collected from a rocky place in Mananur forest.

Flowering season.—Jan.-Feb.

150. **Meriandra bengalensis** Benth. (Bengal sage) Lab. 189; H.F.B.I., iv, 653; Cooke. F. Pres. Bomb., ii, Pt. iii, 475; Kirt. Ind. Med. Plts., iii, 1996.

Indian Names.—Kafur-ka-patta (Deccan and Bomb.); Kafurkapat (Hindi); Simakarpuramu (Tel.); Sayayilai (Tam.).
Habitat.—A native of Abyssinia—cultivated in gardens.
Flowering season.—Almost throughout the year.
Uses.—Medicinal.

151. **Leucas mollissima** Wall. Pl. As. Rar., i (1830), 62; H.F.B.I., iv, 682; Cooke F. Pres. Bomb., ii, Pt. iii, 469; Watt, Dict. Econ. Prod. I., iv, 634.

Habitat.—Common in the vicinity of the city. First collected from Umberpet from a hedge.
Flowering season.—Oct.-Dec.

XLVIII. NYCTAGINACEAE.

152. **Boerhaavia repanda** Willd. Sp. Pl., i (1797), 22; H.F.B.I., iv, 709; Dalz. & Gibs., 213; Wt. Ic. t. 1766; Cooke F. Pres. Bomb., ii, Pt. iii, 480.

Indian Names.—Punarnava, Pungali (Bomb.).
Habitat.—Collected from Mahboobnagar.
Flowering season.—Dec., but it is in flower more or less throughout the year.

XLIX. AMARANTACEAE.

153. **Alternanthera echinata** Sm., in Rees, Cycl. Suppl. n. 10.

Habitat.—Common at Adigmet.
Flowering season.—Aug.-Jan.

L. POLYGONACEAE.

154. **Polygonum glabrum** Willd. Sp. Pl. ii (1799), 447; H.F.B.I., v, 34; Dalz. & Gibs., 214; Wt. Ic. t., 1799; Cooke F. Pres. Bomb., ii, Pt. iii, 514; Watt Dict. Econ. Prod. I., vi, Pt. i, 318; Kirt. Ind. Med. Plts., iii, 2098.

Indian Names.—Sheral, Raktarohida (Bomb.); Atalari (Tam.).
Habitat.—Found in ditches and wet places.
Flowering season.—Oct.-Feb.
Uses.—Leaves are medicinal.

155. **Polygonum tomentosum** Willd. Sp. Pl., ii (1799), 447; H.F.B.I., v, 30; Trim. F. Ceyl., iii, 411; Cooke F. Pres. Bomb., ii, Pt. iii, 515; Gam. F. Pres. Mad., vii, No. vii, 1189.

Habitat.—Common in wet places at Adigmet and elsewhere.
Flowering season.—Dec.-April.

156. **Muehlenbeckia platyclados** Meissn. in Bot. Zeit., xxiii (1865), 313; Cooke F. Pres. Bomb., ii, Pt. iii, 519; Gam. F. Pres. Mad., vii, No. vii, 1192.

Syn.—*Coccoloba platyclada* F. Muell. in Bot. Mag., xix (1863), t. 5382.
Habitat.—A native of Solomon Islands, often grown in gardens.

LI. PIPERACEAE.

157. **Piper nigrum** Linn. (Pepper)) Sp. Pl. (1753), 28; H.F.B.I., v, 90; Dalz. & Gibs. Suppl., 84; Cooke F. Pres. Bomb., ii, Pt. iii, 526; Gam. F. Pres. Mad., vii, No. vii, 1206; Wt. Ic. t. 1935; Watt Dict. Econ. Prod. I., vi, Pt. i, 260.

Syn.—*Piper trioicum* Roxb. Fl. Ind. i (1832), 151.
Indian Names.—Kalimirch (Urdu); Golmirch, Kalimirch, Safedmirch (Hindi); Filfilesiyah (Pers.); Filfiluswud (Arab.); Marichamu (Tel.); Kalimirch (Mar.); Agutlam (Tam.); Kalimari, Kalimirich (Guj.); Menasu (Canarese); Golmorich (Beng.); Golmirich (Punjab).
Habitat.—Cultivated. Kindly presented to the Botanic Garden, Osmania University by Mr. Chacko of Cocanada.
Uses.—Economic and medicinal.

LII. EUPHORBIACEAE.

158. **Euphorbia pycnostegia** Boiss. Cent. Euphorb. (1860), 9; H.F.B.I., v, 246; Gam. F. Pres. Mad., vii, 1274; Cooke F. Pres. Bomb., ii, Pt. iii, 565.

Habitat.—Collected from Mulug.
Flowering season.—Dec.

159. **Euphorbia Clarkeana** Hook. f. F. B. I. (1887), 253; Cooke F. Pres. Bomb., ii, Pt. iii, 570.

Habitat.—Collected from Adigmet.

160. **Euphorbia tortilis** Rottler, ex Wight Ic. t. 898; H.F.B.I., v, 256; Gam. F. Pres. Mad., vii, No. vii, 1277.

Indian Name.—Pedda jamadu (Tel.).
Habitat.—Common in dry situations in some of the districts.

161. **Bridelia montana** Willd. Sp. Pl. iv (1805), 978; Kirt. Ind. Med. Plts., iii, 2214.

Indian Names.—Geia, Khaja (Hindi); Asana (Mar.); Gundu bigalu, Pantangi (Tel.); Vengaimaram (Tam.); Asano (Guj.).
Habitat.—Common in the hilly tracts in Mulug.
Flowering season.—Sept.-Nov.
Uses.—Medicinal.

162. **Phyllanthus simplex** Retz. Obs. Bot. fasc. v (1789), 29; H.F.B.I., v, 295; Dalz. & Gibs., 234; Cooke F. Pres. Bomb., ii, Pt. iii, 587; Kirt. Ind. Med. Plts., iii, 2224.

Indian Names.—Bhuiavali (Mar.); Uchchiyusirika (Tel.); Motibhonyaanmali (Guj.).
Habitat.—Common at Adigmet.
Flowering season.—Aug.-Nov.
Uses.—Medicinal.

163. **Phyllanthus nanus** Hook. f.; H.F.B.I., v, 298.

Habitat.—Collected from the vicinity of Adigmet.

164. **Phyllanthus debilis** Herb. Ham. ex Wall. Cat. (1828) sub n. 7892; H.F.B.I., v, 299; Cooke F. Pres. Bomb., ii, Pt. iii, 588.

Habitat.—Collected from Adigmet.

165. **Pedilanthus tithymaloides** Poit., Gam. F. Pres. Mad., vii, No. vii, 1346.

Habitat.—An American shrub cultivated in gardens.

166. **Plecospermum spinosum** Trecul, in Ann. Sc. Nat. ser. iii, Vol. viii (1847), 124; H.F.B.I., v, 491; Wt. Ic. t. 1963; Cooke F. Pres. Bomb., ii, Pt. iv, 642; Gam. F. Pres. Mad., Pt. viii, No. viii, 1352.

Indian Names.—Koriti (Tel.); Achingudi, Daiyal (Tam.); Bendaka (Canarese).
Habitat.—Cultivated.
Flowering season.—April-June.

LIII. URTICACEAE.

(MORACEAE).

167. **Ficus tomentosa** Roxb. Hort. Beng. (1814), 103; H.F.B.I., v, 501; Wt. Ic. t. 647; Cooke F. Pres. Bomb., ii, Pt. iv, 646.

Indian Names.—Jivi, Juvi (Tel.); *Kallu-goli* (Bomb.); Ichchi, Kal-ichchi (Tam.); Kal-al (Malayalam); Kallatti (Canarese).
Habitat.—A common tree in the hilly tracts in Mulug.
Flowering season.—April.

168. **Holoptelea integrifolia** Planch. in Ann. Sc. Nat. Ser. iii, Vol. x (1848), 266; H.F.B.I., v, 481; Dalz. & Gibs., 238; Wt. Ic. t. 1968; Cooke F. Pres. Bomb., ii, Pt. iv, 629.

Syn.—*Ulmus integrifolia* Roxb. Corom. Pl. I. (1795), 56, t. 78; Kirt. Ind. Med. Plts., iii, 2293.

Indian Names.—Dhamna, Kumba, Papri (Hindi); Kaladri, Tapsi (Canarese); Papara, Vavli (Mar.); Aval (Malayalam); Avali (Tam.); Nevili, Tapasi (Tel.); Chirabilva (Sans.).

Habitat.—Grown in gardens, doubtfully indigenous.

Uses.—Medicinal.

(URTICACEAE PROPER).

169. **Pilea microphylla** (Gun-powder or Artillery Plant). Liebm. in Vidensk. Skr. ser. v, Vol. ii (1851), 296; Cooke F. Pres. Bomb., ii, Pt. iv, 659; Gam. F. Pres. Mad., Pt. viii, No. viii, 1379.

Syn.—*Pilea mucosa* Lindl. Coll. Bot. (1821) t. 4; H.F.B.I., v, 551.

Habitat.—A native of S. America, extensively cultivated as a border herb.

An interesting feature about the pollen is that, when ripe, it is discharged in clouds from the anthers when the plant is slightly shaken.

170. **Pellionia Daveauana** N. E. Brown, in Gard. Chron. (1880), Pt. ii, 262; Cooke F. Pres. Bomb., ii, Pt. iv, 659.

Habitat.—A native of Cochin-China, grown in baskets as an ornamental plant, and also in rockeries.

Regarding the ejection of pollen the same remark applies to this plant as to *Pilea microphylla.*

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EXPLANATION OF PLATE.

Fig. 1.—Photograph of a moist forest near Salvoy in Mulug. In the foreground is a river—Dayyum Mudgo, in the background are lofty trees.

Fig. 2.—A panoramic view of a part of the Ajanta Hills where the forest is of the Monsoon type.

Fig. 3.—Photograph of a thicket of *Calamus Rotang* Linn. near the Ramappa tank in Mulug.

REVIEW

THE BOOK OF INDIAN BIRDS by Sálim Ali. With 171 coloured, 18 black and white plates, 3 line plates and a map. Bombay Natural History Society, Bombay, Rs 14.

Every one enjoys birds. The beauty of their forms and colouring, the vivacity of their movements and the sweetness of their songs make bird-watching past time for the out-of-doors that for fascinating is without equal.

In spite of the wealth and variety of birds, closer acquaintance with them has hitherto been difficult due to the scarcity of a handy, well illustrated and simply written volume which every one could conveniently carry into the field and which at the same time would be within the reach of the modest purse.

Such a book has now appeared and will, we are sure, be welcomed. It contains 171 full page coloured plates and descriptions of 181 of the commoner birds to be met with about cultivation, towns, and villages, jheels and scrub jungles in the plains of India and about the seabound.

The coloured plates, while they do not as a whole claim to reach a high artistic standard, will certainly serve the purpose for which they are intended namely to enable the reader to name his bird. They are the same as were used in the Bird Charts the Society issued some years ago, and with which most people interested in Indian Birds must by now be familiar.

Opposite each coloured plate is the description of the bird illustrated. This is subdivided into the following sections: Size, Field Characters, Distribution, Habits, Nesting. In addition the book contains a number of chapters of general interest including an Introduction to bird study, nesting, migration, economics and bird watching.

What we consider to be a feature of the book is the keys to identification by prominence of crest or bill and by colour which should prove of great help to the beginner and the layman.

Another detail we are glad to see is that the size of the bird is indicated not in inches as is customary, but by comparison with a standard of size which must be familiar to most people such as crow, sparrow, bulbul, myna and so on. As the author points out size given in inches for a bird in the field means little to the layman and may be even misleading where abnormal necks, bills or tails have to be dealt with.

All the latest information gained in the various ornithological surveys carried out in India during recent years, as regards distribution, habits, taxonomy and other branches of bird study have been embodied in the text.

The 18 odd black and white plates, reproduced from the author's own photographs and from those of such well-known bird photographers as E. H. N. Lowther and R. S. P. Bates add considerably to the attractiveness of the volume and the migration map specially prepared for the book is of much interest.

The Society are to be congratulated on this their latest effort to popularise natural history and we feel that this is decidedly a book that must be on the shelf of every bird lover be he young or old.

MISCELLANEOUS NOTES

I.—RIVERS AS BARRIERS TO THE DISTRIBUTION OF GIBBONS.

With reference to my note on Gibbons published on page 434 of volume xlii of the *Journal,* I have now had an opportunity of investigating the status of this animal at Sadiya and have found one small party in the jungle to the north of the station. This means that these animals are present east of the Dibang River, but not west of it, thus further defining the area mentioned in my previous note where they are quite definitely absent. I still have to obtain information with regard to the area west of the Subansiri River.

DIBRUGARH,
LAKHIMPUR DISTRICT,
ASSAM, *August* 31, 1941.

R. E. PARSONS,
Indian Police,
F.R.E.S.

II.—WHERE A TIGER SHARPENED HIS CLAWS.

(*With a photo*).

I enclose two photos I found when going through my collection which you might like to publish. The tree was on the side of a jungle

road, along which a particularly large tiger used to promenade. The tree is an Arjan (*Terminalia Arjuna*). The fire-watcher is standing on a slightly lower level than the ground at the near edge of the tree; the top claw mark was 10′ 6″ from ground level. The deeply scored claw marks indicate the energy put into the process, and if one pictures the tiger standing against the tree in the position indicated by the marks, one gets a vivid idea of the might of the tiger. It is a good illustration of paragraph 1 on page 63 of Dunbar Brander's 'Wild Animals in Central India'.

BETUL, C. P.,
August 3, 1941. C. E. HEWETSON, I.F.S.

[The passage from Dunbar Brander book reads as follows:—

'Another habit of tigers, which they occasionally practise, is to sharpen or clean their claws on trees. This habit seems to be more an individual peculiarity constantly practised, rather than a general habit occasionally practised; as where the marks on trees are seen they are usually numerous and made by the same animal, whereas miles of jungle containing tigers may be devoid of all signs of the habit. I knew a particular Mohwa tree in a certain valley in the Melghat where a tiger regularly scraped his claws every three weeks or so. He evidently stood up on his hind legs and pulled his claws down, making deep incisions in the bark. This practice had been going on for years, but no other tigers for miles round indulged in it.'—EDS.]

III.—ON THE HEIGHT AND AGE OF AN ELEPHANT.

(*With a plate*).

The fine tusker, Chandrasekharan, belonging to H. H. the Maharaja of Travancore, died last year of old age.

He was a magnificent animal standing 10′ at the shoulders. Captain S. S. Flower (later Major), Director, Egyptian Government, Zoological Service, who visited Travancore in 1913, described him in his Report on a Zoological Mission to India (p. 14) as the 'tallest male elephant' that he 'saw actually measured in India'. After death, the Museum Taxidermist deputed to prepare the animal's skin, reported his height as 10′ 7″. Major Stanley in the Report quoted above mentions three instances of elephants going over 10′ in height—a male 'measured by Sanderson as 10′ 7½″; Col. Hamilton's record of Sir Victor Brooke killing one of 11′ and a skeleton in the Indian Museum of Mr. W. M. Smith's Bilkandi Elephant, measuring 11′ 3″—which would indicate that the animal must have been nearly 12′ high in the flesh, if the skeleton was properly mounted. Regarding his skeleton, Mr. W. T. Blanford has a footnote in his *Fauna of British India*—Mammalia—(p. 464) which explains that he was told by Mr. Sanderson that the femur of the mounted skeleton and of another elephant known to have been less than 10′ high, on comparison, showed only a difference of 1/8″.

The elephant Chandrasekharan died on 10-4-1115 M.E., i.e., A.D. 1940. The records about his age vary and are conflicting. From his appearance he must have been past 95 at the time of death. He was taken over to the Royal Stables on 15-8-1058 (A.D. 1883) from the Travancore Forest Department. His tusks were symmetrical and graceful and swept up in a semicircular curve. The weight of the tusks is 142½ pounds.

Major Stanley writing on the age of Chandrasekharan in the same report, says that he had an ascertained minimum age of twenty-five and a supposed approximate age of forty years in 1913. This would mean that the animal might have been between 52 and 67 years of age at the time of death. This is considerably low, compared with Mr. W. T. Blanford's statement that an 'elephant is fully grown, but not fully mature, at 25 years of age, and individuals have been known to live over 100 years in captivity; in a wild state their existence probably extends to 150 years', and the evidence furnished by 'Ortela' the famous 170-year old elephant of Ceylon described on p. 619, Vol. xxxix of the *Journal of the Bombay Natural History Society.* Major Stanley's study on the duration of life in vertebrate animals which appeared in the *P. Z. S.*, 1931, based on actual observations for a number of years brings out 50 as the average life of elephants. It is interesting to note that the thirteenth century Jain Zoologist, Hamsadeva, has said in his 'Mrigapakshisastra' that the maximum age attained by elephants in captivity is 100.

The elephant was particularly remarkable for his sagacity, gentleness and almost human intelligence. He never harmed a living creature till his death. Various stories are current evidencing one or other of his qualities, an authentic one being his refusal to erect a pillar in one of the pits dug for the purpose in connection with one of the Murajapam festivals in Trivandrum. Usually the elephant was a very willing worker and his refusal to hoist the pillar which he held still with his tusk and trunk surprised the mahout who on looking into the pit found that a dog which had strayed in had got into the pit had fallen asleep. It was only after the dog was roused and driven away that Chandrasekharan lowered the pillar into the pit.

The death of an animal so remarkable for his size and intelligence, was a personal loss to H. H. the Maharaja, whose kindness to animals is proverbial. As a tribute to this mighty pachyderm, its head is set up and given a prominent place in the Royal Art Gallery, 'Ranga Vilas' at the Fort, Trivandrum.

TRIVANDRUM, *August* 22, 1941.

N. G. PILLAI, *Curator, State Museum, Trivandrum.*

IV.—THE MALAYAN ELEPHANT.

There are four points in Mr. Theodore Hubback's excellent article under the above caption (August 1941 *Journal*—Vol. xlii, No. 3) I should like to touch on.

' Chandrasekharan ' in a placid mood

—and in ' Musth '

Firstly the description of the young of Malayan Elephants having sometimes . . . 'a thick coat of black, and in part, bristly hair' . . , in the *Proceedings of the Zoological Society*, 1914, may well apply to the young of Indian Elephants also. Mr. Hubback just describes the appearance of a two-day old elephant calf I saw, and filmed, a few yards from me, in 1936—in the North Coimbatore jungles. I have never seen any other young calf so covered with black 'bristly' hair as this was.

2. The Malayan idea that the 'pengasoh' (foster-mother) is the more aggressive when both female elephants are with the calf may not be far wrong. Some years ago I was out in the Minchiguli Valley of North Coimbatore with a friend, and we came on a herd of elephants—a bit separated from which were 2 cow-elephants and a small calf. While we were watching the calf's antics with its mother the wind suddenly changed, betraying our presence. The mother-elephant shuffled off with the calf between its legs: while the other cow swung round and made a determined charge on us. We had to run for it!

3. I found about 18 inches of an elephant's tusk embedded in a tree once: it was a clean break: and the tree was split.

4. Elephants bite each other's tails when fighting: the loser on turning to flee, is 'speeded on' by having a portion of its tail bitten off.

5. I am particularly interested in Mr. Hubback's description of an elephant using a waterfall as his trail (*vide* last para on page 503). In 1929, while following a rogue elephant on the Baragur Hills, I was amazed to find that the elephant had climbed the face of a small dry waterfall—in a ravine—leaving a good path to do so. Had I not personally verified this I would never have believed it to be possible. Further, there was no apparent reason for the climb—which was quite 12 feet, possibly more.

6. I once watched a bull elephant with most abnormal tusks (quite 6 feet long outside and so wide apart that they must have been almost useless to him in a fight) standing on the outskirts of a herd, in which there were two other fine tuskers, and spending his whole time trumpeting loudly. I think he was made to keep his distance from the herd: and was furious! On another occasion a bull elephant, after being disturbed by three successive flashlights in a nulla (set with trip-wires) vented his wrath on the trees in the vicinity of the third camera, laying them all flat!

REINFORCEMENT CAMP, R. C. MORRIS,
BOMBAY, *Captain.*
September, 15, 1941.

V.—AN ALBINO NILGHAI

(*With a photo*).

I enclose a snapshot of a fawnish white Nilghai (male) shot by His Highness the Thakore Saheb of Palitana the other day in the State, which may interest your readers,

It was shot in open country about ten miles from the Capital and is the first of its kind ever seen this side.

The animal was in very good condition, about 5 to 6 years old, with $6\frac{3}{4}''$ horns and had an orangeish-coloured mane and tassel.

THE PALACE,
PALITANA,
KATHIAWAD,
August 9, 1941.

T. R. TRIVEDI,
Private Secretary to H. H. Palitana.

VI.—MEASUREMENTS OF A FINE HEAD OF THE INDIAN GAZELLE.

I am sending you by passenger train the head of a Chinkara or Indian Gazelle (*Gazella bennetti*) which has been shot by my brother Sardar Gurbachan Singh and shall be obliged if you will kindly have it measured and the measurements recorded in your *Journal.*

NABHA,
August 20, 1941.

SARDAR SHIVDEV SINGH,
Prime Minister,
Nabha State, Nabha (Punjab).

[The measurements of the Chinkara head sent to the Society by the Prime Minister, Nabha State, are recorded by us as follows:—

Length on front curve.	Circumference.	Tip to tip.
15″	4″	$6\frac{1}{8}''$

The measurements of the record head given in Rowland Ward's *Records of Big Game are*:—

Length on front curve.	Circumference.	Tip to tip.
$15\frac{5}{8}''$	$4\frac{3}{4}''$	$5\frac{1}{2}''$

This animal was shot at Bhalinda? (Punjab) and the trophy is in the possession of Major-General Sir P. C. Palin. 'Bhalinda' is probably a misprint for Bhatinda.—Eds.]

VII.—KING CROW BULLYING TERNS.

An interesting incident was witnessed by several of us at Ferozepur on 26-2-1941, and as I have not noticed an account of such behaviour in any of the publications to which I have had access, it may be worth recording.

The scene was one of the canals which still held a few stretches of shallow water wherein a number of small fry (fish) attracted a gathering of some dozen or so River Terns (*Sterna aurantia*). Seated on a small tree on the canal bank was a King Crow (*D. macrocercus*) which, as soon as one of the Terns had made a successful plunge, gave chase and forced the latter to drop its prey which was then caught in mid-air, taken to its perch and devoured piece-meal by the King Crow, the fish being held down by the latter's feet and torn to pieces much as a Falcon does with its prey.

SIMLA, A. E. JONES.
April 1941.

VIII.—PRESUMPTIVE EVIDENCE OF THE NIDIFICATION OF THE INDIAN CUCKOO (*CUCULUS MICROPTERUS* GOULD).

(*With a plate*).

Six years ago while staying at Dehra Dun I visited the late O. C. Ollenbach on several occasions when we used to talk 'Natural History'. During one of these visits our conversation turned to the question of cuckoos' eggs and he asked me if I had ever found a cuckoo's egg in the nest of a king-crow, or drongo. I had to admit that I hadn't, neither had I heard of it but I made a mental note of it.

That same year, or the next, I forget which, my friend Mr. Edwin Hotz, who is a keen naturalist, up in Simla on a bit of leave from Delhi, voluntarily told me he had seen a young cuckoo being fed by a king-crow. Here was confirmatory evidence of some member of the genus cuculus victimizing some of the Dicruridae.

Looking through the list of victims of *Cuculus canorus* and its subspecies in both the *Fauna* (2nd edition) and *Nidification* I found no mention of any of the members of the Dicruridae being victimized.

Now taking in order the other cuckoos, as per the '*Fauna*' we have *Cuculus optatus*, and *C. policephala* we find the eggs of both are well known, moreover the eggs of both species are considerably smaller than the egg of *C. canorus*.

Next in rotation comes *C. micropterus* Gould, the Indian Cuckoo, and here we find that except for (a) the remains of an oviduct egg obtained by La Touche which he described as 'pinkish-white marked with rich red and carmine, *very much like some eggs of the Dicruridae*, and (b) the record of a complete oviduct egg obtained by Stewart in Travancore, which is described as 'all blue, of rather a grey shade'. Finally we have Rattray's assumption (*Nidification*, vol. iii, p. 347) that blue eggs which

he found in nests of *Trochalopteron lineatum, Hodgsonius phœnicuroides, Larvioora brunnea* and *Saxicola torquata indica* all of which birds lay blue eggs pertained to *C. micropterus.* About these Stuart Baker remarks; 'They are *probably* correctly identified as those of the present bird, but in appearance are not distinguishable from those of the Common Cuckoo.' Besides this evidence we have the case of Major R. E. Skinner's collector who 'saw one of these Cuckoo's sitting on the nest of a Paradise Flycatcher, and waiting until it flew away, examined the nest and took a Cuckoo's blue egg and two eggs of the owner from it.' How this man could identify the species of cuckoo in the field except from the call of the male is beyond me. Even in the hand the identification of *C. canorus, C. optatus* and *C. micropterus* is difficult. The 'Water-bubbling' notes of the females of all three are practically the same.

Now for my own evidence. For the last three or four years we have been used to hearing the mellow call '*kyphul pukka*' (as we syllabalize it up here) of *C. micropterus* during April and May mostly, but occasionally in June, at elevations between 5,000 ft. and 7,000 ft., while at lower altitudes, i.e. 3,000 ft. to 4,000 ft., its call may be heard as late as September.

Personally I have not taken a nest of a king-crow (*Dicrurus longicaudatus*) for a number of years, but this year my elder son has taken two, both of which call for notice. The first was taken on May 18 and contained *five* eggs but due to an accident three of these had been broken. However, on examining the two remaining eggs it was obvious that one was a cuckoo's of some species. On the 30th he found another king-crow's nest this time containing one more or less normal egg of the rightful owner while the second egg was *exactly like the Cuckoo's egg taken on the 18th.*

Next, a young friend of ours, David Cotton, an extraordinary good field naturalist, hearing about these presumed cuckoos' eggs looked up the three clutches which he had taken this year in the same locality as the two nests above mentioned and brought two of them to me for critical examination. Here again each of these nests contained *one egg exactly like the two cuckoos' taken by my son*, and all five eggs evidently, so alike are they, laid by the same bird.

A most extraordinary feature with regard to four clutches of the king-crows' eggs is that they are pure white without a mark and slightly rough in texture as are also the Cuckoos'.

The colouring of the supposed five cuckoos' eggs is dead white ground, sparcely marked with blotches and spots of pale brick red scattered evenly all over the surface of the shell. In size they are slightly smaller than the drongos'.

At these elevations we find *Cuculus canorus* victimizing *Lannius S. erythronotus, saxicola t. indica, Enicurus maculatus* and, rarely, *Oreocorys sylvanius* and know all the various types of this cuckoo's eggs fairly well, having on three separate occasions actually witnessed it lay its egg in the nest of the Stone Chat (*S. torquata indica*). The five eggs in question are like no cuckoo's eggs previously seen by me.

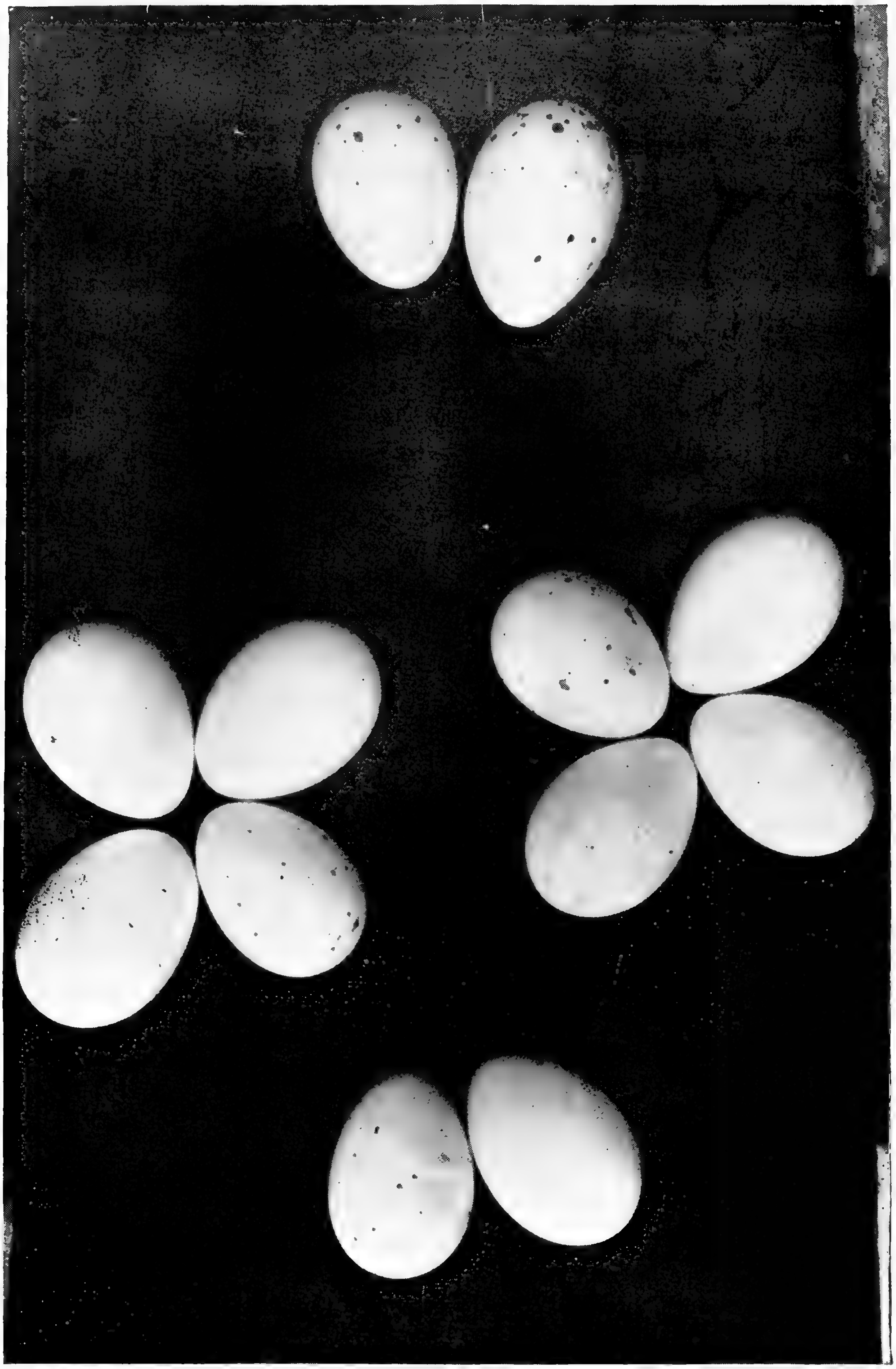

Photo : *Col. E. A. Glennie*

Nidification of the Indian Cuckoo (*Cuculus micropterus*)

For explanation see end of note.

To sum up, we have:—

1. Two independent accounts, i.e., Hotz and Ollenbach of King-Crows being cuckolded by some species of Cuckoo.

2. Five cuckoos' eggs, taken in one circumscribed locality, all from nests of *Dicrurus longicaudatus*.

3. No record either in the *Fauna* (2nd ed.) nor in *Nidification* of the eggs of *Cuculus canorus* ever having been taken (among thousands of records of other victims) from drongos nests, but the record of fragments of an oviduct egg from *C. micropterus* obtained, as previously cited, by La Tuche, described by him as resembling some eggs of the Dicruridae. Now these five eggs (the cuckoos) might easily have been passed over for poorly marked king-crows' had it not been for the fact that the eggs of the latter happened to be unmarked in four cases (nests) out of five.

4. Detection was due to there having been five eggs in the first nest taken by my son, this being a most unusual number laid by any of the Dicruridae.

5. The cuckoo, whatever its species, had taken up its breeding quarters amidst a 'pocket' of king-crows (four out of five of them) whose eggs are quite abnormal, being un-marked, pure paper-white. This we must however allow is purely fortuitous, but I mention it because had these king-crows' eggs been normally poorly-marked ones (at times one finds very handsomely marked ones) it would have been more than likely that the eggs of the interloper would have been overlooked.

6. The dates on which four of these nests were taken are May 14th e/4, 18th e/5, 21st e/4, and 30th e/2. Elevations between 5,500 ft. and 6,000 ft.

SIMLA, A. E. JONES.
July 1941.

The photograph, for which I am once again extremely indebted to Col. E. A. Glennie, shows the four sets of eggs. Of the top pair the right-hand egg is the more or less normal type of drongo or king-crow egg, while the one alongside it is one of the supposed cuckoos' eggs, which will also be seen (one in each) in the other three clutches. The photograph shows the actual size of the eggs. The photograph is also valuable in showing the rather unusual type, unmarked, of drongo or king-crow (*Dicrurus*) egg.

IX.—THE GREAT BLACK WOODPECKER IN THE NEIGHBOURHOOD OF BOMBAY

On the 1st June, 1941, I was out at Suriamal (45 miles north of Bhiwandi, along the Wada Road on the southern border of the Nasik District), with Messrs. C. McCann and Dinshah Panday. During the course of a morning's tramp through mixed moist deciduous forest along a hill-side, we saw a Great Black Woodpecker (*Macropicus javensis* subps.) at very close quarters.

This woodpecker is large and unmistakeable, and this record extends the known range considerably northwards. In flight it has a grotesque resemblance to a cross between a hornbill and a crow! The white patch on the lower back is distinctive. A loud cackling laugh appears to be commonly uttered. A pair seen near Sirsi (Dharwar Dist.) on the 8th Sept. 1939, also kept in touch in a similar manner. The female of this pair was shot and had dormant ovaries. Her stomach contained a mass of large black ants, as well as slivers of wood $\frac{1}{2}$ in. to $\frac{3}{4}$ in. long.

Among other birds seen around Suriamal, Grey Tits (*Parus major*) were common, and one of them was observed carrying nesting material. The Little Sunbird (*Leptocoma minima*) was also common. Both these species are unrecorded from the immediate neighbourhood of Bombay.

BOMBAY, HUMAYUN ABDULALI.

June 21, 1941.

X.—THE BOOMING BITTERN [*BOTAURUS STELLARIS STELLARIS* (LINN.)] IN LOWER BENGAL.

Recently, the Director, Zoological Survey of India, received from Mr. D. J. McMullin, Assistant Superintendent, Coaching, East Indian Railway (Calcutta), a beautiful female specimen of the Booming Bittern. Mr. McMullin writes that he shot the bird on the afternoon of January 7, 1940, among *hugla* grass in a *bhil* (lake) about two miles south-west of Barasat (Barasat Sub-Division, 24-Parganas District, Lower Bengal), and adds that 'it was accidentally shot as it was taken for a Bengal florican when it rose'.

The measurements of the bird are as follows:—Body-length, 485 mm.; Wing, 300 mm.; Tail 120 mm.; Tarsus, 90 mm.; Culmen, 66 mm.; and Mid-toe with claw, 120 mm.

The Booming Bittern is a palaearctic bird resident in the temperate areas from Western Europe to Manchukuo and Japan. It migrates in winter largely to the countries around the Mediterranean and to South-West Asia, and in much smaller numbers to India, Burma and Southern China. Within Indian limits it occurs in small numbers throughout Northern India and as far south as Bombay, the Deccan and even, it is said, Bangalore. It does not breed in India. (Curiously enough, Hartert in his standard work *Die Vögel paläarktischen Fauna,* vol. II (1920), pp. 1262-1263, does not mention India, Burma and Southern China within the over-wintering range of this bird.)

Owing to its rarity, the bird is seldom encountered in India and I have, therefore, thought it fit to record a recent instance of its occurrence in Bengal. Apart from rarity, its capture is made difficult by the fact that it is a nocturnal bird, hiding by day in long, dense beds of rushes and reeds in swamps,

Intimation of any future Indian records of this bird, as well as skins of it, will be welcomed by the Zoological Survey of India, Calcutta.

CALCUTTA,
10th April, 1941.

M. L. ROONWAL,
M.SC., Ph.D. (*Cantab*).
Zoological Survey of India, Calcutta.

XI.—BIRD 'BATHING' IN ANTS.

I wonder if the following note on the 'anting' habit of the Common Mynah will be interesting to the readers of your esteemed *Journal.*

On the morning of December 14, 1940, I saw a pair of Common Mynahs (*Acridotheres tristis*) 'anting' themselves on the lawn in front of the Museum. The birds were seen to hop about in the midst of a colony of Red Ants (*Oecophylla smaragdina*) picking them in their beaks one after the other, rubbing them against the underparts of their wings and tail and finally dropping them. After being thus engaged for about three minutes, they flew away. On the scene of their activities, I found a number of red ants strewn about, dead and dying. All had their abdomens flexed and crushed at the pedicel and were reeking of formic acid recently liberated.

Again, on June 28, 1941, at the same spot, I saw a pair of mynahs engaged in the same act. This time I had noticed the birds at a distance feeding among the grass and working their way in the direction of the ants. As my curiosity was roused, I took my stand nearby to watch. On seeing the ants they at once set to pick them up in their beaks and behave exactly as before, spreading and quivering the tail during the act. They did this for nearly a minute and then moved on. Soon, a pair of White-headed Babblers (*Turdoides striatus*) feeding in another part of lawn came that way, but took no notice of the ants, and hopped clear of them to the adjoining lawn. I made an examination of the spot as soon as the birds had left, but there was no sign of the shambles I expected to see, save for a disabled ant which I removed to my table. Under a lens, the legs appeared intact and though the abdomen was bent over on its stalk, it was free from rupture and presented no trace of any body juice. At first the ant could hardly move, but soon it recovered and was able to get about as vigorously as ever, so I had it restored to its comrades.

According to the notes previously published on the subject in this *Journal*, the following birds have been observed to pick up and press on their plumage insects with obnoxious effluvia:—

(1) *Dryonastes coerulatus* and the nestlings of *Trochalopterum nigrimentum* and *erythrocephalum*, *Dendrocitta baylei*, (Rhynchota)—B. B. Osmaston.

(2) Jerdon's Chloropsis—(Red Ants)—Humayun Abdulali.
(3) Song thrush—(Red Ants)—Major R. S. P. Bates.
(4) Drongo—(Ants—Red?)—T. B. Fletcher.

In all the above cases, the insects were swallowed afterwards, but in (3), as well as in the instances described above, the birds were observed to drop them.

Besides these, the Magpie (*Pica pica*), Jay (*Garrulus glandarius*), Starling (*Sturnus vulgaris*), the crow (*Corvus corone* and *cornix*), *Leiothrix lutea*, *Lioptila capistrata* and *Garrulus* species, the Thrushes (*Turdus musicus* and *philomelos*) and Dipper (*Cinclus cinclus*) are also known to indulge in this habit, using in addition to ants, cigar ends, mealworms and Floh-Kerbs (?) and many acid fluids such as lemon juice and vinegar.

TRIVANDRUM,
August 12, 1941.

N. G. PILLAI,
Govt. Museum, Trivandrum.

XII.—SURVIVAL OF BIRDS AFTER INJURY.

Mr. W. P. Keelan's note in this *Journal* (Vol. xlii, No. 1, p. 191) on a Mallard which lost portions of the web and toes, the latter being mere stumps, the cause of which he attributes to frost-bite or a jaw-trap, reminds me of the injuries to one of my pets, a Baya (*Ploceus philippinus*), which survived in spite of the total loss of a leg.

Early in 1940 I was living in a small village, but the house I was occupying was comparatively good as it was the property of the State. One morning one of my pets, a bulbul, was missing. I found its feathers under its cage which lay on a shelf. The cage had a wire netting, but the door had a slit ½ by 3½ inches and I suspected the marauder had dragged out its victim through this slit, but left the other bulbuls untouched. Worried for the safety of my other pets, I took them to another room. I was afraid the unknown visitor might come from the roof, so I placed the half a dozen cages on a cot until better arrangement could be made. My pets included parrakeets, bulbuls, munias, larks, a pair of koels, a grey partridge, a Nepal mynah and a cockatoo. Nothing untoward happened for some days. Then one night I was awakened by the alarmed twittering and calls of my birds. My wife and I rushed to the room which had no access to cats. We shuddered at the horrible carnage we saw in one of the cages occupied by White-backed Munias, Spotted Munias, Red Amadavats, larks and a baya. The victims were bleeding profusely. Some were already dead, some were dying. A pair of Spotted Munias was unscathed. The baya had lost its left leg entirely. Nothing was left of its leg except a blood clot on the belly. No time was lost to reach and search the room, but no trace of the enemy was found. Wire-mesh of the cage hardly allowed entry of the tip of one's first finger. The cage measured 1½ by 1½ by 1¾ ft. Near the top of the cage, on one side, some feathers were clinging and there were blood stains indicating where the enemy had unsuccessfully tried to draw out

its victims. No bird was missing. The only survivors in the cage were the pair of the Spotted Munias and—to my extreme surprise and pity—the one legged Baya. I cannot yet imagine the author of this carnage. The other cages on the cot were untouched.

Next night I placed the one legged baya in the same cage on the same cot and lay in wait in the adjoining room for the enemy. Nothing happened; only a musk rat was heard chirping. I had seen it the previous night when I searched the room, but I had not suspected it of the crime.

The Baya with its one leg lived many months in quite good health. The loss of one leg hampered its movements, but it could support itself on the perch and at night it perched quite firmly. When I returned home I had, due to circumstances, no alternative but to set it free in a garden.

Can you suggest the name of the mysterious enemy? Could it have been the musk rat?

PORBANDER, V. M. VASU.
August 14, 1941. *Advocate.*

[The common musk shrew is insectivorous—insects, cockroaches in particular being the object of its entry into houses—but these shrews have been known to eat meat and may attack small birds or mammals—this taste for meat-eating may be more developed in a particular individual; or the culprit may have been an ordinary house rat. The attacker undoubtedly seized its victim from outside, the frantic fluttering of the birds against the wire-mesh giving it the opportunity to seize them.—EDS.]

XIII.—FURTHER OBSERVATIONS ON THE EGG-LAYING HABITS OF THE LIZARD, *CALOTES VERSICOLOR* (BOULENGER).

In a paper (Asana '31) published in this *Journal* the writer has given an account of some natural activities of this lizard including his observations on the egg-laying habits of this creature and the number of eggs normally laid. Subsequent to the publication of this paper there appeared in the year 1935 in the well known series *The Fauna of British India,* a work by Malcolm A. Smith, entitled 'Reptilia and Amphibia, Vol. II—Sauria'. In this work is included a short account of the breeding habits of the species, *Calotes versicolor,* in which reference is made to some of the observations made by the present writer in his paper (Asana '31) mentioned above. In this connection Malcolm A. Smith ('35) on page 193 of his work says, 'These observations are not in accordance with my own, made in Indo-China or with those of Deraniyagala made in Ceylon. I have never known them to be buried more than a couple of inches below the earth, and the number deposited may vary from 4 to 12. They vary in size from 14-15 mm. long by 8-9 mm. broad'.

On July the 20th of this year an excellent opportunity luckily came my way to confirm those of my observations in which

Malcolm Smith differs from me, barring one observation, the depth of the hole in the soft earth in which the creature lays her eggs. On this occasion I have been fortunate enough to watch at close quarters in the compound of my bungalow a female performing all her operations for laying the eggs, almost from the beginning to the end of her effort, literally under my very nose.

On the morning of the date mentioned above, my wife, while returning from the garden, accidentally caught sight of a calotes digging a small pit in the somewhat moist earth on the surface of the ground. The hole, the animal was making, was quite close to the wall of the low-plinth verandah, not even two inches distant from it. When my attention was first drawn to it, it was about 15 minutes past 10 o'clock in the morning. I could watch the creature from a very favourable position without disturbing it in the least. Myself bending low on the window-sill I could see her working directly below me on the ground hardly 4 feet away.

She was intensely preoccupied and had nearly completed digging the pit. While she was shovelling out the scraped earth from the bottom of the pit, employing only her fore feet in both these operations, more than half the length of her body was inside the hole. Noting the rate at which she worked one could estimate that she must have started digging the hole somewhere between 9-30 and 9-45 *that morning* working without a break. I intentionally use the words, *'that morning'*, because I infer that she had been working continuously the previous 30 to 45 minutes. The reasons for this inference are that (1) the earth that had been scraped out looked quite fresh, moist and granular, and (2) during her subsequent operations, when I was watching her closely and continuously, she never left the spot and worked continually.

The colour of her fore feet and that of $1\frac{1}{2}$ inches length of the spines-bearing ridge on the dorsum just behind the occiput was dull crimson or brick red. She worked all the time with her fore-feet using each limb alternately one after the other. The scraping and throwing out of the soil, both these operations, were performed by the fore feet alone, never by the hind limbs, which simply rested on the brink of the hole supporting her body. At intervals she would rest for a few seconds. The hole was made ready to receive the eggs at about 34 to 35 minutes past 10 o'clock, she having taken nearly an hour to complete it. The completed hole, as observed later, was about 3 inches broad at the rim outside, narrowing down below to the depth of about $3\frac{1}{2}$ to 4 inches.

Having finished this part of her job, she took her head and body out of the hole and sitting on the pit turned towards the east in a direction opposite to that when she was digging. She rested for a while, her hind limbs stretched over and across the hole. Then she began to eject out of her body and cloaca the eggs, which dropped one after the other down the pit, the process starting at about 10-36 a.m. During this time she lay almost motionless, across the pit her fore limbs pressed back on either side of the anterior part of the trunk. A few seconds before an

egg dropped out of the vent, a wave of contraction would pass over the abdominal wall pressing the egg outwards. In the early stages of the process, the interval between two successive eggs was about 45 to 55 seconds. Later it increased to about 60 to 70 seconds.

Twenty-one eggs were counted as they dropped into the hole, the actual egg-laying operation lasting for about 23 to 25 minutes. All this time the creature lay entirely motionless across the pit, except for the periodic contraction of her abdomen, the head and anterior half of the body pressed against the ground. The last egg laid she rested for about a minute and a half, then turned round over the hole, her head again directed towards the south.

Then she lowered the anterior part of her body and her fore limbs again into the hole. Resting these fore limbs against the opposite sides of the pit, she began spreading out and pressing the egg heap with her snout as if to arrange the eggs inside. About two minutes were devoted to this part of her work, the operation of scraping the earth for covering the eggs commencing at about 11 a.m.

Bringing her fore feet again into use she began to scrape out the earth from the sides of the pit, throwing it all on the eggs. After collecting a certain quantity she would beat the loose, granular earth with her snout and press it hard on the egg mass, resting at intervals. She toiled and laboured in this way for about half an hour, gradually filling in the hole. During this time she never changed her position, nor did she bring her hind limbs ever into play. The pit was completely filled in at about 11-32 in the forenoon. During this half hour too she was continually at it and never left the spot. After the hole was filled in she levelled the disturbed area, again with her fore feet, stayed there for a couple of minutes and left the spot.

If we presume that she first commenced marking out the area near the wall and scraping the earth for a hole some time between 9-30 to 9-45 a.m., she took about 2 hours to finish the job. During this period she worked almost continuously, taking little or no rest, and she never left the spot, certainly from about 10-15 to 11-35 a.m. and most probably from 9-30 or 9-40 a.m. to the end. This seems to be a remarkable feat in more ways than one for a creature so small.

I examined the spot after waiting for about half an hour for her return. If the creature had not been seen working there, it would have been difficult to say that a hole had been dug out in that little area, so cleverly it had been filled in and all traces of disturbance removed. The eggs were unearthed and counted again in the presence of our assistant, Mr. R. G. Kharadi, B.Sc. There was no mucous on them and they were not glued together and were quite clean, spotlessly white and exactly 21 in number. In size they did not differ from those mentioned in my previous paper (Asana '31), being about 10-11 by 4-5 mm. But they were found laid in fairly soft, moist earth the female calotes had raked up not more than $2\frac{1}{2}$ to 3 inches below the earth.

It was a most interesting experience watching this fascinating phenomenon of nature at such close quarters. If it could have been reproduced in a film the mother *Calotes* might have well proved a star performer. One regrets having missed the opportunity.

GUJARAT.
20th July, 1941.

J. J. ASANA,
Gujarat College,
Ahmedabad.

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XIV.—REMARKABLE FEEDING HABITS OF AN INDIAN CARP [*BARBUS (PUNTIUS) DOBSONI* DAY].

The following observation may prove of interest to fellow fishermen and naturalists.

On repeated occasions I found the stomach and intestine of the Carp, *Barbus* (*Puntius*) *dobsoni* caught in rivers around Poona, much distended with a mass of finely disintegrated vegetable matter in appearance like chewed-up grass.

The source of this diet intrigued me greatly, as I could not detect much aquatic vegetation in the gravelly pools, where the fish were caught.

The explanation came forth, when I noticed a number of large carp disporting themselves close to a herd of village buffaloes wallowing in a pool of the Nira river. Observation with field glasses from an elevated point disclosed fish approaching the posteriors of the ruminants and gorgeing themselves on their freshly produced dung, thus obtaining this predigested diet so to say 'straight from the horses mouth' or rather the reverse.

My observations were confirmed by Mr. McCann, who had noticed a similar occurrence near the Pinjrapole at the Ulhas river.

The fish weighed from 4 to 14 lbs. and tallied with the particulars given in books of reference for *Barbus dobsoni*, a common carp in our parts.

Nearly all of them were caught on an unshelled groundnut used dry fly fashion.

116, KOREGAON PARK,
POONA.
22nd July, 1941.

M. SUTER,

XV.—A MANTIS-BLOODSUCKER TRAGEDY.

While watering my garden on the evening of the 28th July I spotted a Mantis (*Deiphobe ocellata*) making a meal of a young Bloodsucker (*Calotes versicolor*) almost as large as itself. The

mantis was facing earthwards with the lizard firmly secured in its fore legs. It had eaten the greater part of it. About six inches below, a large bloodsucker was seated on the same pole watching the proceedings. I watched carefully for quite a while when suddenly the large bloodsucker rushed at the mantis. The mantis immediately dropped its prey and assumed a defensive attitude with the forelegs outstretched and ready to strike. The wings were also wide spread. The large bloodsucker snapped up the remains of the little one as they fell and swallowed them, but did not dare to attack the menacing mantis. The bloodsucker then went away. The mantis remained in the defensive attitude for a considerable time after the event.

Those who have handled one of the larger mantids can well appreciate the painful results of a grip of its well-armed pincer-like forelegs, no wonder the bloodsucker was not anxious to tackle the insect. Bloodsuckers do take mantids when they can get them at a disadvantage, but I have on several occasions seen a bloodsucker drop its captive soon after it caught it. *D. ocellata* is not uncommon in Salsette, and there is a good figure of it in Lefroy's *Indian Insect Life*.

Bombay Natural History Society,
Bombay. C. McCANN.
29th July, 1941.

[That the larger mantids sometimes hunt 'bigger game' is certain. In the Society's Museum there is a specimen of a Purple Sun Bird taken in the grip of a mantis. The bird was partly scalped when captor and prey were secured.—Eds.]

XVI.—PARASITIZATION OF LARVA OF THE HAWK MOTH (*OXYAMBULYX SUBOCELLATA*) BY FLIES.

Mr. Sevastopulo's note on the parasitization of *Rhyncholaba acteus* Cr. by Tachinid flies on page 449 of vol. xlii of the *Journal*, and Mr. McCann's previous note on a similar subject but dealing with *Theretra lycetus* Cr., has reminded me of a case in which I found a larva of the Hawk Moth (*Oxyambulyx subocellata* Feld.) parasitized by flies of the genus *Blepharipoda;* but in this instance no caking of the soil was noticed. The pupae of the parasites were distributed in various parts of the breeding cage.

Dibrugarh, R. E. PARSONS,
Lakhimpur District, F.R.E.S.,
Assam. *Indian Police.*
28th June, 1941.

XVII.—EFFECTS OF THE BITE OF THE LARGE MYGALOMORPH SPIDER (*CHILOBRACHYS* SP..).

I have today despatched under a separate cover a large spider of the tarantula type and shall be pleased to have your opinion on it. I have never seen such a large spider or one of this hairy type

in this part of the world and it would be of interest to know if it is of a species commonly found in India.

It was disturbed in a stack of fire-wood which was inside the house of one of the labourers on the Keyhung Division of this Company. A girl aged eight years took some firewood from the stack and in doing so dislodged the spider which bit her on the hand causing a very painful swelling.

A report on the case has been drawn up by Dr. K. P. Hare, the Medical Officer of this District, from particulars given him by our Indian Assistant Medical Officer.

Dr. Hare unfortunately was not able to examine the case as it was not reported to him. His report is now given.

REPORT ON CASE OF SUPPOSED SPIDER BITE AT KEYHUNG T.E.

'*First day.*—A female child aged 8 years came in contact with a large spider which was said by the parents to have bitten her on the dorsum of the left hand. She was seen by the A.M.O. 2-3 hours later when the dorsum of the hand was swollen and red all over. The swelling was not hot. In the centre of the swelling there was a black mark, circular in outline, about $\frac{1}{4}$ inch in diameter but no puncture could be seen.

Second day.—The swelling had increased and had become hot. The black centre was unchanged.

Third day.—The black centre had become vesicular and burst, exuding a serous discharge. There was no slough in the base of the ulcer.

Fourth day.—The main swelling was subsiding but the central ulcer had increased to a diameter of about 1 inch. There was some slough in the base but the exudate was still serous.

Fifth day.—The size of the ulcer was increasing, and sloughing was more marked. The exudate was still serous.

Sixth day.—The ulcer had further increased in size, and suppuration had commenced.

The condition remained fairly stationary until :—

Tenth day.—The slough separated and the exudate again became serous and the inflammatory swelling subsided.

From this day granulation commenced with slow healing.

Throughout the course there was no rise of temperature.'

TINGRI TEA CO., LTD.,
HOOGRIJAN P.O. & T.O.,
11th June, 1941.

T. WOOLY SMITH.

[The spider has been identified as *Chilobrachys* sp. (probably *fumosus*). These large hairy spiders are commonly called Tarantulas —though the true Tarantula takes its name from the town of Tarentum in Italy and is confined to the Mediterranean littoral. All spiders possess a pair of poison glands opening near the tip of the fangs, but few seem to have the power of injecting their poison into human beings. It is believed that the poison is not automatically ejected whenever the fang is used, but is under the spider's control. Dr. Gravely in his interesting article on Indian Spiders

(*Journ., B.N.H.S.*, vol. xxviii, p. 1045) gives a few instances of poisoning by large Mygalomorph spiders. The bite may be attended with pain and swelling which may extend up the bitten limb and may persist for 24 hours.—EDS.]

XVIII.—A CENTIPEDE EATING ITS EGGS.

It is well-known that the centipedes display a certain amount of parental care; brooding their eggs and coiling round their young till they are able to fend for themselves. The centipede (*Scolopendra* sp.) in question is a small metalic bluish-black species found very commonly in the Ghats. On the 20th July, at Khandala I found one coiled round her creamy coloured eggs under a stone. I put her, together with her eggs, into a tube. In the tube she also coiled round the egg mass. On the 25th morning I found that she had devoured all her eggs. This eating of the eggs was evidently occasioned by hunger as I had put nothing into the tube for her to eat, and is, of course, not habitual, especially in an animal that displays parental care. However, it points to one thing, namely, that under normal conditions the parent periodically leaves her eggs or young to feed.

This centipede breeds commonly between the months of July and September during which period I have frequently found it with either eggs or young.

BOMBAY NATURAL HISTORY SOCIETY,
BOMBAY. C. McCANN.
29th July, 1941.

XIX.—A NOVEL WAY OF COLLECTING BOTANICAL SPECIMENS.

(*Wayside Trees of Malaya* by E. J. H. Corner, Hongkong Naturalist, vol. x, Nos. 3 & 4, 1941.)

Anyone who has ever visited a stretch of jungle in any State in Malaya will have realized that it is by no means easy to study and to know the trees. When a tree is 150 feet high and has no branches for the first 60 or 80 feet it is difficult to collect specimens of leaves, or flowers or fruits for determination and study. Mr. Corner uses a telescope, not binoculars, to bring the foliage nearer but specimens are essential. One method is to use a .12 bore shotgun and to hope that a lucky shot will bring down enough fragments to be of value. But Mr. Corner evolved a new technique. He recruited, as an experiment, a berok monkey, *Macacus nemestrina,* the well-known Pig-tailed Monkey which is widely used in the East by Malayas for gathering coconuts. Merah, as it was named, proved a great success. 'On one occasion in Johore, for instance, it worked in the crown of a Wild Chempedak at the height of 170 feet: on another day it collected specimens from 24 trees, all of which were over 100 feet in height.' 'At the end

of his days, Merah was able to find in the trees flowers and fruits which had been shown him on the ground: and he knew the meaning of 18 words of Malay.' It took a genius to think of training monkeys to collect botanical specimens but it took a man of infinite patience and equipped with a rubber-neck to use them successfully. Monkeys so often behave like mischievous children and the effort of gazing up at the crown of a tall tree, minute after minute, whilst shouting directions to a disobedient monkey in an atmosphere like a Turkish-bath and attended by swarms of thirsty mosquitoes, requires considerable strength of character and calls for physical fitness of a high order. Unfortunately Merah developed an obscure disease and had to be put away but he was followed by two others, Jambul and Puteh, which were purchased by the Department and probably were the first two monkeys ever to enter Government service! In this book Mr. Corner has limited his attention to wayside trees and the study of these in only rare instances necessitated the assistance of his monkeys, but we have mentioned them as an illustration of the thoroughness and enthusiasm with which he carries out his researches on the flora of the country.

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